ELECTRICAL REVIEW

[ILLUSTRATED.]

A WEEKLY JOURNAL OF

ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

(Formerly Review of Telegraph and Telephone.)

Vol. 7, No. 1. WEEKLY. NEW YORK, SATURDAY, SEPTEMBER 5, 1885. $3 per annum. Single Copies, 10 Cents.

Copyright, 1885, by Electrical Review Publishing Company, 23 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

The Electric Lock.

This is a lock that can be used in all houses for front doors, or any doors, especially in high flats. It can be opened by the aid of electricity from any part of the house. There are push-buttons on each floor, which when pushed, unlock the door down stairs. It saves the running down stairs in answer to the bell. There is a self-closing drop which slides up and down. When the door is unlocked the sign drops down where it can be seen. There are letters on the sign saying, "open," which indicates that the door is unlocked. This drop is placed on the outside of the door in suitable height for any person to see it when the party on the outside turns the knob and opens the door. The lock is so arranged that it rings a bell in the hallway so as to alarm the tenants of the house, and notify them that somebody has opened the door. The large bolt that locks the door can be easily removed by the hand from the inside of the house. This lock affords a key for the purpose of coming in at night. This key is so arranged that when pushing it through a small keyhole in the door it lifts the bolt and the little sign drops down When the circuit is closed the door is opened as soon as the knob is turned. You can see it operate through a length of 1,200 feet or more of office wire at 72 Hudson st., Hoboken, N. J. The inventor is W. C. Lockwood, with office at the address mentioned, and at 131 William st., New York.

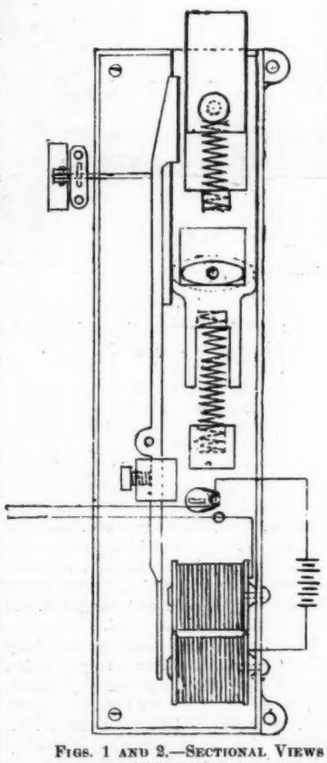
The Glaesener Secondary Battery.

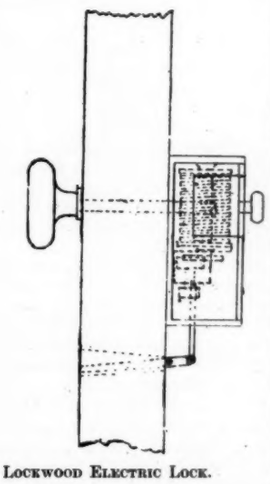
MM. Glaesener Freres, of Chatillon, near Arlon, in the Belgian Province of Luxemburg, seek to attain the desideratum of all devisers of storage batteries, of a maximum of surface with a minimum of weight in their electrodes, by rolling continuous bands or tapes of lead having minute projections on both surfaces, so that, when wound spirally into a disc, they permit of the liquid passing freely between them. They assert that their accumulator is the lightest, for a given duty, of any hitherto brought out on the Continent. This battery has lately been brought into notice through its application to the lighting by Swan lamps of the Luxemburg Prison, which is referred to below.

The lead tapes forming the electrodes are one centimeter or 0.4 in. wide, and about 0.4 of a millimeter thick, having on both sides small hemispherical projections, varying from 0.1 to 0.5 of a millimeter in diameter. Each tape 30 meters, or nearly 100 ft. long, is wound spirally, so as to form a disc of 5 in. diameter, weighing 1,200 grammes, or 2 lbs. 10 oz., and presenting an effective surface of, on an average, rather over 62 square dicimeters or six square feet, 100 square inches. Although these electrodes are used without any coating, they lend themselves admirably to receiving a coat of red lead, which is held between the folds of the spiral. Besides, as soon as the accumulator begins to act, the red lead is held more closely, on account of the expansion of the electrode and the consequent tightening of the spirals.

The discs are arranged, as shown in the accompanying vertical and horizontal sections, in a pile of 11, with wooden crosses between, coated with a highly-insulating varnish. To the bottom cross, which is stronger than the rest, are pinned four wooden uprights, which are attached to the cover, provided with a handle, so that the whole may be inserted and withdrawn from the glass jar, containing dilute sulphuric acid. The outer ends of the electrodes, arranged alternately positive and negative, as shown in the section, are wrapped round vertical lead rods, put in connection with the binding screws. An electrode has been shown which had been in use six hours a day for more than a year, and the lead of which, though brittle, was not eaten through.

MM. Glaesener Freres lighted their own works at Chatillon about two years ago with twenty 10-candle Swan lamps, maintained





Figs. 1 and 2.—Sectional Views of the Lockwood Electric Lock.

by 25 accumulators, the lead of each of which weighs 6 kilogrammes, or 13 lbs. They are charged, from four to six hours a day, with a current of 55 amperes at 15 volts; and there has been no hitch hitherto. The next installation was at the Saint-Leger Roller Flour Mill, which is driven by water, so that no additional expense was incurred for the power absorbed. A small Gramme dynamo charges 40 accumulators, the lead of which weighs 18 kilogrammes, or about 40 lbs.; and these maintain 16 Swan lamps. The installation cost, in round numbers, 1,500 fr. = £60; so that, putting 10 per cent. for interest and depreciation, and 50 fr. = £2 for maintenance and renewals, the expense of a year's lighting, for an average of 10 hours a night, is 200 fr. = £8, or 6 centimes (about a half-penny) an hour. This is just the same price that was paid before for paraffin; but the lighting is now 50 per cent. better, without counting the diminished risk from fire.

The prison at Luxemburg is lighted by twenty-five 10-candle Swan lamps, distributed among the workshops, passages and guard-house, and maintained by 30 accumulators, the lead of each of which weighs 12 kilogrammes, or 26 lbs. They are charged by a Gramme shunt dynamo, of the workshop type, giving out 70 to 80 volts at 21 amperes when making 1,500 revolutions a minute. A charge of 70 to 80 ampere hours is found sufficient for the lighting required, viz., a few hours every night, one lamp, however, being maintained all through the night. On one occasion, by way of trial, the accumulators, charged for an hour, by a current of 70 volts at 14 or 15 amperes, maintained a Swan lamp of 50 volts at 0.65 ampere for about 20 hours. The dynamo is driven by a broken-down old portable engine, the speed of which is so far from being constant that it certainly would not do for electric lighting but for the accumulators acting as a regulator, and so maintaining a steady light.

* * Gaiffe's new medical galvanometer contains but one needle and has no directing magnet. Correct proportion between the current strengths and deflections is obtained by means of a special form given to the frame upon which the wire is wound.

* * We are glad to note that M. Trouve has obtained a silver medal at the International Inventions Exhibition for scientific research. Probably no living inventor has contributed more variously to electrical science than this eminent French electrician

* * The Admiralty have decided to arm Pylades with 14 steel long-range breechloading guns, 5 in. in diameter, on the Vavasseur system of carriages. She will carry ten broadside guns and two fore and aft, so as to command an all-round fire. She will also receive a strong equipment of Gardner and Nordenfelt machine guns, and will be fitted with electrical machinery for discharging the spar torpedoes. When completed for active service she will be the strongest vessel of her class afloat.

Underground Conduits.

Now that the various cities of the United States are moving in the matter of underground conductors for all kinds of electrical currents, the attention of inventors is earnestly directed toward various systems of accomplishing the desired end by methods which have for their ultimatum perfect insulation, not only from the earth, but between the conductors themselves; permanency of material and a capability of resisting the ingress of moisture, inflammable and poisonous gases; and, above all, the best results for the least outlay of capital.

A large majority of the systems recently invented are as yet untried by time, which is, after all, the only real test; for there are many well known substances which at the outset are thoroughly good and reliable, yet after a sufficient lapse of time these become as thoroughly worthless.

A system which brings the above thoughts to the surface has the advantage which time alone can give to a material for the purpose named, and the test of years has been eminently satisfactory.

The Dorsett conduit is constructed, with but little variation, of the original material—asphaltum and pure silex—like the Dorsett sewer pipe, which has been used for six years under the most trying circumstances for sewerage and drainage, buried at varying depths in the soil, and subjected to a temperature of 27° below zero, without injury. It is moulded in longitudinal sections under a hammering pressure of several thousand, pounds while hot and almost fluid, and when cold resists a crushing strain of 5,500 pounds to the square inch, according to government tests by J. E. Howard, at the Watertown (Mass.) arsenal, in 1883. So compact is the material that an inside hydraulic pressure of 180 pounds is incapable of forcing the least moisture through a thickness of one inch. The conduit, which is a thoroughly good insulator from the very nature of its composition, is made in sections of three feet, having a diameter of 10 inches, and perforated with seven two-inch holes. One end of these sections is flanged to allow the entering end of the adjoining section, and the joint, at the time of laying, is cemented by boiling hot material. This joint is, by the process of cementing, made a homogeneous part and parcel of the pipe, so that these connections, being a little larger than the main pipe, are actually the stronger portion. Breaking tests show that the line of junction between two such surfaces has perfectly disappeared.

The manholes, as in other systems, are placed opposite street corners or other required places, and are made of the same material, the entering conduits being cemented by the same welding process. The man-hole cover of iron is peculiarly and ingeniously arranged to not only perfectly exclude water and keep the manhole thoroughly dry, but a spring arrangement, without impairing its other properties, allows of an elasticity which protects the cover from breakage. An inner diaphragm is secured by a lock which prevents tampering with the wires.

The Dorsett conduit is the system used by the city of Chicago, having been selected by

15299

UNIV. OF MINN. LIBRARY

the city electrician from among all the various underground systems presented—and their name was legion—through some years of careful investigation and tests. It is also being introduced in St. Louis, Cincinnati and Detroit, as well as some cities of minor importance.

The wires of the Chicago city fire-alarm, telegraph, telephone, electric light and police systems running to the city hall, are all brought to the building through Dorsett conduits, where they were placed during the summer of 1884. These conduits were placed beneath the thoroughfares of the city, at depths below which the soil was solidly frozen by the low temperature of an exceptionally cold season; yet no break or injury was experienced, and not one dollar has been expended for repairs upon the city wires of this system. The Chicago Telephone Company have also occupied a half mile of these pipes with 300 wires for a year.

Wires are being laid in these conduits by the Western Electric Company, the several electric light companies, and the various wire plants of the corporation are being rapidly extended through them; and, as an experiment, an electric-light circuit, on which there are about 40 arc lights burning nightly, runs for nearly one street-square, where there is no other insulation between the naked wire and the ground, save the conduit proper.

As the material of which these conduits is made is impervious to the action of both acids and alkalies in addition to being a non-absorbent of water, sewage or other moisture, combined with its other properties, it would seem an excellent system for its purpose.

The plan adopted by the proprietor of the system in the various cities in which it is now being introduced, is the organization of a company for the purpose of constructing and controlling a complete and comprehensive net work of underground conduits. Such companies are composed of individuals who are not interested in any existing telegraph, telephone or electric-light companies. The company controls its conduits, and leases to the various electrical companies or parties desiring the same, the individual ducts, giving them the right at a certain rate per mile of each duct, granting them the privilege of drawing into the same such insulated wires or cables, and as many of them as they may elect.

It is a well-known fact in electrical practice, that a much less degree of insulation is essential between wires, to insulate them from each other, especially where metallic circuits are used, than is required to insulate them properly from contact with the earth. As a material out of which this conduit is formed is in itself as nearly a perfect insulator as has been discovered, the saving in the expense of individual wire insulation where a large number of lines are in use, is sufficient to pay the rental of these ducts at the rate charged.

After the cable or wires are drawn into these ducts, the manholes are locked by the service company, which then becomes the custodian of the property of the different companies. Access to the manholes, or attention to the wires thereafter must be under supervision of an authorized officer or agent of the conduit company. A guarantee is also given in the leases that a reliable service will be provided so far as the conduit is concerned.

The company in Chicago, of which Prof. Elisha Gray is president, has already completed and in actual service more than six miles of this conduit, over half its capacity being now occupied at a rental per mile that is not equivalent to 10 per cent of the charges heretofore made by existing telegraph companies for the use of their wires on poles.

Aluminium and Electricity.

NEW YORK, Aug. 25, 1885.

Editors of the Electrical Review:

Six years ago I succeeded in obtaining aluminium oxide ($Al_2 O_3$) from clay at a total cost of 7½ cents per pound, but gave up my search for a cheap method of isolating aluminium at that stage of the experiment, because I was unable to reduce the aluminium from its oxide without using sodium or other equally expensive methods. Since then, while experimenting in an entirely different line, I discovered what I believe to be a cheap method of reducing $Al_2 O_3$ by the combined action of heat, electricity and a cheap chemical. $Al_2 O_3$ contains 55 lbs. aluminium to 48 oxide, and hence the aluminium as an oxide costs 14 cents a pound. The additional process costs as nearly as I can determine 15 cents a pound more, to this must be added the cost of *clay* and *labor*. With the exception of saturating the crude clay and drying it, the process requires a day.

Intimately connected with this experiment and necessary to its successful production on a cheap scale is the cheaper production of electricity by the direct oxidation of carbon in a primary battery at a low temperature and by non-luminous combustion.

I can, on short notice, show a chemical dissolving and oxidizing carbon.

E. C. OHMART, M. D.

The American Institute Exhibition.

The Board of Managers of the American Institute of New York have determined to open their 54th Annual Exhibition at the Institute Building, Third avenue, 63d and 64th streets, on Wednesday, September 30th next, and are now busily engaged in arranging and perfecting the details incidental to a show of such magnitude as this always is. The building is now being put in thorough repair, and it is to be entirely redecorated and painted throughout, in order to make it bright and cheerful.

Already a large number of applications for space for all kinds of exhibits have been received, and, judging from the character of these entries, the coming exhibition promises to be more than usually interesting, and many very great novelties in the way of machinery and other things are promised.

The exhibition will be divided into seven departments, consisting of fine arts and education, the dwelling, dress and handicraft, chemistry and mineralogy, machinery, intercommunication, and agriculture and horticulture. These again will be subdivided into seven groups each, each group having three judges, who will examine all articles exhibited, and make their report thereon to the Board of Managers, by whom the awards and prizes will be made.

These awards will be, as usual, very numerous, and will comprise the following medals:

The Medal of Honor (gold), which is only awarded for an article or process which shall show a marked improvement on those previously in use, and be considered of the highest importance in science or the arts. This is awarded on the recommendation of three judges, approved by a majority of the Board of Managers, and confirmed by a majority of the Board of Trustees.

The Special Medal (silver), awarded only for an article of great importance and extraordinary merit. This medal may be offered for a certain number of exhibits in each year, a list of which shall be prepared by the Board of Managers.

The Medal of Taste (silver), awarded for any article or process which is considered of unusual excellence in the first four groups of the Department of Fine Arts and Education.

The Medal of Superiority (bronze), awarded for an article or process of great value. The Medal of Excellence (bronze), for articles or processes of importance; and the Medal of Merit (bronze), for articles or processes of acknowledged merit.

In addition to the above, diplomas are also granted for "maintained superiority," for "continued excellence" for an article or process of acknowledged value, as well as to employes who by their skill add to the attractiveness of the exhibition. Awards in money may also be made for the best skill and workmanship by apprentices, as likewise to exhibitors of perishable products.

A special and marked feature of this year's exhibition will be its opening with a grand show of flowers, palms and ferns, which will be continued for four days, viz., from Wednesday, September 30th, to Saturday, October 3d, both inclusive. In this display a large number of the best-known horticulturists, both amateur and professional, have already signified their intention to take part and compete for the valuable premiums offered. It is, therefore, anticipated that this innovation will not only be a most enjoyable one, but will serve as an additional inducement to exhibitors generally to have their exhibits in place on the day of opening.

All intending exhibitors should bear in mind that early application for space greatly facilitates classification, and in most instances secures a more ample and suitable location than otherwise might be the case.

A display of fruits and vegetables will take place on the second week of the exhibition, to be followed by others in succession of palms, ferns, evergreens, etc., while the largest and grandest exhibition of chrysanthemums ever seen in this country, including new specimens from China, Japan, France and Germany, as well as home grown, will bring the floral show to an end.

Intending exhibitors should without delay send in their applications for space to Mr. Chas. Wager Hull, the general superintendent, at the offices of the institute, Clinton Hall, Astor place and Eighth street, N. Y., who will also furnish proper forms, and any information that may be needed.

The entrance fee for exhibitors will be, as usual, $10, no charge being made for space which is allotted according to the merit and description of goods to be shown. This fee gives the exhibitor the right of admission to the exhibition building for himself and one employe.

DORSETT'S UNDERGROUND CONDUIT.

—— Mr. J. W. Warren, of the Los Angeles (Cal.) Electric Light Company, is visiting the East, and inspecting the various incandescent systems of electric lighting. In his city there are 265 arc lights (Brush). The city is one of the most satisfactorily lighted of any in the United States. There are 18 masts, 150 feet high, each carrying 3 or 4 arc lamps of 3,000 candle-power, and 11 masts 60 feet high, carrying one lamp. The city has about thirty-five thousand inhabitants, who patronize the electric light company quite liberally.

International Telegraphy.

The most prominent question coming before the telegraph conference now in session at Berlin is the reform and reduction of international telegraph rates. This is the seventh congress of representatives of the great telegraph interests of the world which has been held during the last quarter century. The suggestion for such a gathering came first from the Belgian government, under whose auspices a conference was held in Brussels in 1858, and from this resulted the Universal Telegraphic Union. This union at first embraced only European states, but at each successive meeting, at Paris, Vienna, Rome, St. Petersburg, and, lastly, at London in 1879, other countries were represented, until at this time the union includes the entire eastern hemisphere. The United States is the only country having an extended telegraph system, and also intimate commercial relations with Europe, that is not included in the Union; a circumstance due not so much to the separation of this country from Europe, which existing cable connection really obliterates, or to the fact that there is no government control of the telegraph in the United States, as to the manner in which, and the purposes for which these great interests are owned and manipulated here.

The results of the conferences heretofore held are seen in the simplification of the telegraph service and the regulation and reduction of rates, all of which is for the public benefit. At the last meeting, in London, the first step was taken in this direction by the adoption of the "word tariff," at the suggestion of the German government and from the same source comes the proposition to establish one system of tariff for the whole of Europe, which is at the present time under discussion by the congress at Berlin. The scheme, as proposed by Prince Bismark, consists of a fixed tariff of ten cents on all international European telegrams, together with a rate of four cents for each word, and an additional rate of two cents when transmitted by submarine cable. The sending office collects the rates according to this tariff, and settles all charges of connecting lines according to an established schedule, varying according to the countries over whose local lines the message must pass.

This arrangement is so directly in the path of the policy which the British government is pursuing that the opposition of the English representative at the Berlin conference is not readily understood. The government has recently given preference to Mr. Shaw-Lefevre's sixpenny-telegram scheme for inland messages, of which the proposed international plan is only an extension, and there is no doubt of the disposition of the commercial community, which has long been calling for it. The tendency of telegraphic management abroad is, indeed, so strongly and definitely in the direction of economy and convenience to the public that even the immense personal and private interests which oppose similar reforms on this side of the water must, before long, feel its influence.

—— Important experiments were made at the torpedo station, Newport, R. I., with the arc search light, which is used at sea as a headlight, and can be put to port or starboard at will. The mechanical portion is operated by electricity as well as the light. The light exhibited and experimented with was of 15,000 candle-power. It was thrown seaward and the smallest boats and vessels were distinguished at remote points. The light was turned toward the inner harbor, and that, with the city's wharves, were scanned most minutely, and with perfect success.

The Bentley-Knight Electric Railway.

Messrs. Bentley & Knight, whose electric railway is illustrated herein, have, after a year of work on a practical commercial scale, brought their system to that point from which valuable results may be expected. An interesting account of a trip over their Cleveland road is given below.

That the electric railway has great advantages over the cable roads is beyond doubt. It is enough to say that the first cost is so small as to place the latter for ever out of competition, while the perfect regulation of speed, the ability to run in either direction, the simplicity with which branches, switches, curves and crossings are operated, and the absence of mechanism requiring attention along the line, are some of the other advantages which must inevitably give the electric system the preference.

This is set forth very convincingly in the circular which has just been issued from the office of the company at 115 Broadway.

"I recently paid a visit to the Bentley & Knight electric railway, which runs from the end of the Garden street horse-car line, two miles out, into the suburbs of the city of Cleveland. I boarded one of the cars of the line down town, and in about twenty minutes we reached the company's stable on the corner of Kennard street.

"Here the horses were taken off, and I went to the front platform to see the electric motor by which we were to complete our trip. Extending between the two rails was the conduit containing the conductors, a box about six inches in depth with a slot ⅜ in. in width opening into it. The conductors could not be seen, and the usual street traffic was passing over the conduit without regard to the fact that a powerful current of electricity was passing just beneath.

"The motor was already at hand, and backing down slowing was coupled on to our car, and in a moment we were moving silently off. The motor car was about half the size of an ordinary open car, and had seats on the sides and ends for 16 passengers. The driver stood in the middle of the car, and, by a single lever, held his machine under perfect control. Across Wilson avenue we went at a good speed, then up a grade of about 1 foot in 40, and around a curve of 50 feet radius into New street, the motor taking both grade and curve with the greatest ease. After two blocks on New street, we made a second turn and were soon bowling along up Quincy street at a speed of 10 to 12 miles an hour.

"Being curious about the maintenance of the connection with the conductors in the conduit, I took a position where I could observe the contact plow extending down into the slot, and though I watched for fully five minutes, there was not a single flash, showing that the contact was perfectly maintained and that the motor on the car had as good and constant a connection with the conductors in the conduit as if it were stationary and its terminals soldered to the mains.

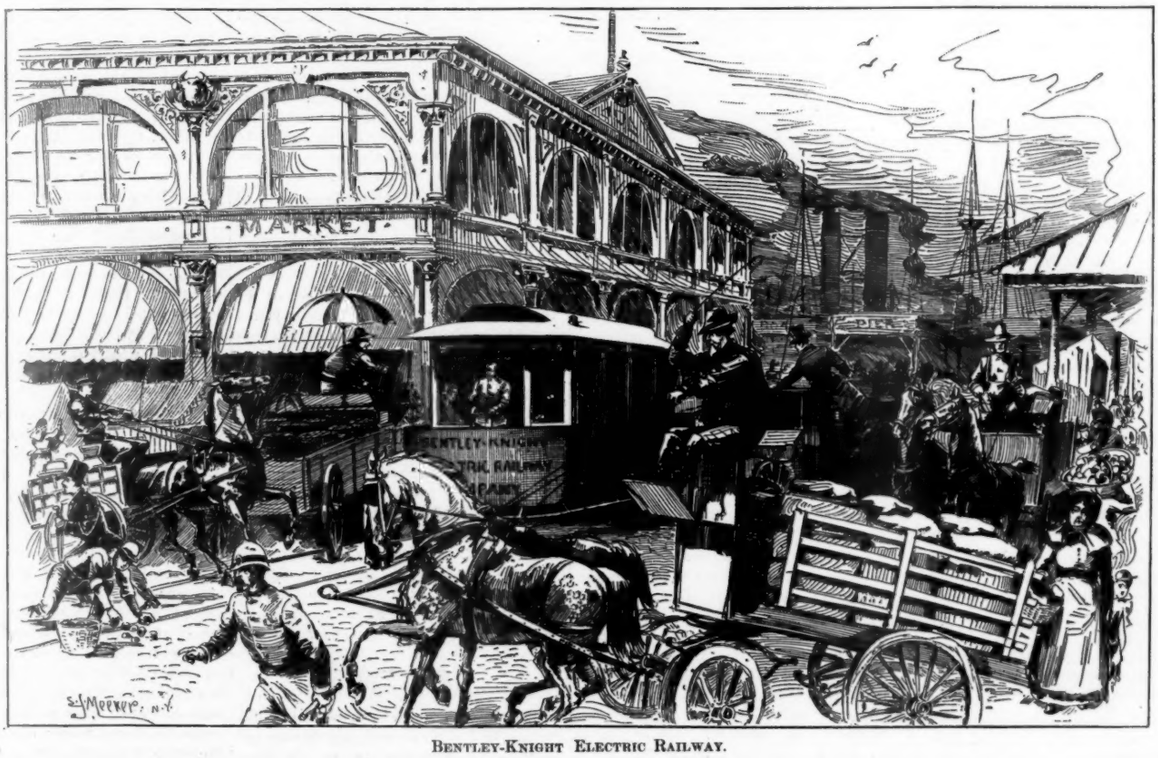
"After a run of a mile with several stops to let off passengers, we came to the turn-out where we were to meet the returning motor. The switch was a fixed one, always throwing the car to the right, and with scarcely any diminution of speed we ran off into the side-track and waited for the returning car which was just at hand. I went forward into the motor car and found the driver to be an intelligent laboring man receiving as he told me $1.75 a day. He said the work was much pleasanter than horse driving, as he had only to sit still and move his lever. He said he had run the car in the deepest snow without difficulty, when horses were steaming and ready to drop from exhaustion.

"The other car, which now passed us, was complete in itself, the motor being placed underneath the floor of an ordinary box car between the wheels. A controlling lever was placed at each end of the car so that it could be driven from either platform. A short distance from the turn-out we came to the tracks of the Cleveland and Pittsburgh division of the Pennsylvania Railway which we crossed without difficulty, the rails being cut to allow the passage of the plow. As the conduit was but 6 inches in depth, the clear passage of the contact plow through the rails was certainly a triumph of ingenuity. Across the railway we had a better track, and we sped along up a steady grade to Lincoln avenue the end of our route. Coming back the motor car pushed before it the car it had pulled out. As we started, I took out my watch, in 2 minutes we were slowing up for the railway crossing, and in nine minutes were back at the barn, having made three stops for passengers on our way. Here the motor, by a running switch, sent the car off into the down-track of the main line, and then backed down and took the arriving car on the up-track for another trip.

"I rode back and forth over the line several times and was more and more impressed by what had been accomplished under the most adverse circumstances.

"Too much praise cannot be given the inventors for the severely practical manner in which they have carried out their experiments.

"They have been conducted openly on a regular commercial street-car line presenting an unusual number of difficulties. Every problem has been resolutely faced and solved, and the success of the system on a first class installation assured."



BENTLEY-KNIGHT ELECTRIC RAILWAY.

A Correction.

NEW YORK, Aug. 25, 1885.

Editors of the Electrical Review:

In your report of the discussion on "Placing Wires Underground," at the recent meeting of the Electric Light Association, your reporter has made me use the term "specific conducting capacity," which is nonsense, when used in connection with the rest of the sentence. It should be "specific inductive capacity." He also makes me say "I shouldn't, undoubtedly, put down a lead cable,"—slightly ungrammatical. It should be "I should, undoubtedly," etc.

Kindly make the above corrections, and oblige,

Yours very truly,
GEO. H. BENJAMIN.

.... In cable operations, especially on a soft sea bottom, it is sometimes difficult to tell when the grapnel reaches the bottom. The experience of the captain of the cable steamer is often relied upon for this, his acquaintance with the strain of the grapnel rope telling him, by the feel of the rope, when the grapnel has landed. Sir James Anderson and Mr. Kennelly, of England, have, however, devised an electrical tell-tale for this purpose. It consists in attaching a hollow chamber at or near the grapnel, and communicating by a wire with a cable running up the grapnel rope to the ship, and in circuit with a battery and electric bell or other alarm. A quantity of mercury contained in the hollow chamber serves to complete the circuit and ring the bell when the grapnel and chamber reach the bottom, because when this occurs the mercury flows until it completes the circuit by establishing contact between the wire to the ship and an earth connection.

.... The Western Union Telegraph Company's office, in Cleveland, Ohio, was destroyed by fire last week. The loss to instruments and wires will reach $2,000, and to the building $5,000. The Mutual Union office will be used until repairs are made.

.... As a result of committee debatings in the telegraph conference, the English companies show a theoretical approval of the German proposals and will offer to reduce the tariff to India sixpence, and to Australia 2s 6d per word, besides a reduction of one quarter on press messages.

.... It has been pointed out that the Ameer of Afghanistan should be moved to consent to the immediate extension of the telegraph to Candahar and Herat. The difficulty of making a line would not be great. A strong ruler like the Ameer could guarantee its safety, and the Indian Telegraph Department could easily train a staff of Mahomedan clerks, whose presence would neither alarm nor irritate the Afghans. Such a line, besides being of the greatest use politically and strategically, would probably soon command a large commercial traffic, for during the British occupation of Candahar the merchants of that place were not slow to learn and avail themselves of the use of the wire. Moreover, when the line was once made to Herat it would be easy to connect it with the Persian system from Meshed and Russian Sarakhs, thus giving a new route between India and England.

.... A metallic telegraph pole has been adopted, it is said, by the Canadian government for its telegraph lines on the North Western prairies. The pole is constructed of malleable galvanized iron, and is only 1⅛ inches in diameter at the top, and 2¼ inches in diameter at the bottom, and weighs less than fifty pounds. The bottom of the pole is set into a claw-plate, upon which the earth is closely packed to a height of about two feet, Then another plate is put into place around the pole, and the earth packed upon it to the level of the ground. The claw-plates take a hold in the ground at once, so that the pole becomes solidly fixed immediately after being set, which desideratum it only obtained by the ordinary wooden pole after it has been in the ground for at least a year. A recent test is said to have shown the great strength of the pole, as a heavy No. 6 Government wire was strung and the poles subjected to the greatest possible strain, but without moving them in the least.

Electrical Review.

Published at 23 Park Row.
P. O. BOX 3329.

GEO. WORTHINGTON, - - - Editor.
CHARLES W. PRICE, - Associate "
LOREN N. DOWNS, - - - President.
C. C. HASKINS, GEO. A. HAMILTON, JOHN W. BEANE, } Consulting Electricians.

SUBSCRIPTION.

United States and Canada, $3.00 per annum, in advance. Postage paid by publisher.

Great Britain and other foreign countries, $4.00, in advance. Postage paid by publisher.

ADVERTISING.

Transient, 25 cents per line, nonpareil.

EDITORIAL ANNOUNCEMENT.

Address all communications and make all checks and P. O. orders payable to order of ELECTRICAL REVIEW P. O. Box 3329, New York

We invite correspondence from Electricians, Inventors and the Telegraph and Telephone fraternity and those engaged in Electric Lighting on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

Mr. J. Viennot, 150 South Fourth Street, Philadelphia, is our accredited representative for Pennsylvania.

Mr. C. C. Haskins, 118 LaSalle Street, Chicago, Ill. will represent the REVIEW in the West.

Messrs. Wm. Dawson & Sons, 121 Cannon Street. London, England, are our representatives for Great Britain.

NEW YORK, SEPTEMBER 5, 1885.

CONTENTS.

	PAGE
The Electric Lock	1
The Glaesener Secondary Battery	1
Underground Conduits	1
Aluminum and Electricity	2
The American Institute Exhibition	2
International Telegraph	2
The Bentley-Knight Electric Railway	3
Editorial Notes	4
Another Opinion of Deprez's Experiments	4
As to the Coming Installation at Portland	4
The Underground Conundrum	4
General Western News	5
Telephonic News	6
Trouble in the New England Telephone Co.	6
Raise in Telephone Rates	7
On the Kicker's Desk	7
National Telephone Exchange Association	7
Telegraphic News	7
Electrical and Scientific	8
The Physical Philosophy of the Future	8
Electric Lighting in Pittsburgh	9
Electric Light News	9
Electrical Patents	10

Theo. N. Vail has resigned the presidency of the New England Telephone Company, and will be succeeded by Gen. Thomas Sherwin, auditor of the Americal Bell Telephone Company.

The REVIEW has received from its electric-lighting friends and friends of the press, many pleasant words of congratulation on the very complete report published in its columns, of the proceedings of the National Electric Light Association, many of these being accompanied by substantial orders for extra papers. We certainly appreciate these kind words and—orders. From among the number of complimentary notices given in the press, we quote one from the New York *Journalist* as follows:

"The ELECTRICAL REVIEW is as brilliant as its name denotes, and is a true index of the great and important subjects whose interests it advocates. With praiseworthy energy and expedition it furnished its numerous readers in its last issue with a very elaborate report of the proceedings of the National Electric Light Association's meeting at the Union Square Hotel."

What tremendous possibilities, in the way of big audiences, the telephone opens. That accurate statistician, Edward Atkinson, says that "all the people now living in the world, say 1,400,000,000, could find standing room within the limits of a field ten miles square, and by aid of a telephone could be addressed by a single speaker. In a field twenty miles square they could all be comfortably seated."

Mr. E. T. Gilliland has tendered his resignation to the American Bell Telephone Company. Probably no one man has done more to advance the legitimate telephone interests of this country, and in the work of inventing and improving apparatus for exchange systems no single individual can successfully compete with him for first honors. A capable inventor, an enthusiastic worker and most agreeable gentleman, Mr. Gilliland will be greatly missed and his departure regretted by the best men in the telephone field. However, his separation from the Bell Company, where he has so successfully superintended their Mechanical Department—one of his duties being to pass final judgment on the numerous inventions received by the company—should not separate him from his old love—electricity—and we hope to see him identified for many years to come with the electrical interests of the country, where there is great demand for a man of his ingenuity and ability.

ANOTHER OPINION ON DEPREZ'S EXPERIMENTS.

The question of the transmission of power to a distance is of such preponderating importance that anything concerning the solution of the problem cannot fail to be of interest to electricians and the electrical fraternity generally. The experiments of M. Marcel Deprez in this direction have attracted what might fairly be called universal attention. Many electricians have expressed an opinion upon these experiments and the likelihood of their success or failure and these have been from time to time recorded in the columns of the REVIEW. Now comes M. Hippolyte Fontaine, one of the foremost and most distinguished of French engineers whose opinion is particularly valuable on the subject of the electrical transmission of power to a distance. In the last number of the *Portefeuille Economique des Machines*, he says in effect:

"We have a profound conviction that, in the actual state of practical knowledge concerning the construction of electrical machines, it is practically impossible to send 100 horse-power from a single generator with a resistance of 100 ohms. Hence it is not possible that the experiments at Creil can accomplish the object sought. Success could not be had even with a steam engine of 500 atmospheres of pressure. Theory, it is true, says Yes, but practice says No.

"For these and other reasons it is useless for M. Deprez to continue his experiments in the line and toward the object he has selected. It is but unnecessary wear and tear upon energies which are worthy to be employed in a more profitable field of electrical science."

AS TO THE COMING INSTALLATION AT PORTLAND.

The recent decision of the authorities of Portland, Me., after a careful examination of the relative advantages of electricity and gas as illuminants, to adopt the former may fairly be looked upon as marking a distinct stage or epoch in the progress of electric lighting. For the Portland authorities, knowing that the city owned two fifths of the stock of the gas companies were naturally and very properly prejudiced in favor of gas lighting. But being honest men, representing the best interests of the public, they were anxious to discover which of these two illuminants would best light the streets of Portland, and, in order to come at this, they instituted a series of comparative tests. That these tests could only end in pointing to the electric light as the superior of gas, everybody knows who is familiar which the countless tests of this nature that have already been made. As it was the electric light showed its superiority from the very start, and the city of Portland, although it owned nearly one-half the stock of the gas companies decided that it was to its best interests to adopt electricity for lighting its streets and public places.

No one better than the gas companies knows what a telling blow this will prove to the pretensions of the gas fraternity generally, or of the effect this example will have upon other communities throughout the country.

No public, it is safe to say, will hereafter listen to the suggestion of renewing a gas contract without inviting the electric light people to furnish an estimate, and giving their claims a careful and pains-taking consideration.

The advantages which the electric lighting possesses, when compared with gas, are the more apparent when we consider that the system of electric-lighting chosen by Portland, is no better than several others that can be named, and far more expensive. The company owning and operating the system chosen has laid claim to nearly everything that has any electricity in it, and since the ground has been discovered to be a reservoir of electricity, it has been expected that this company would lay claim to the whole earth. That ingenious electrician, Starr, who died comparatively unknown, would be surprised and indignant should he come to life to-day and find that the discoveries in incandescent lighting he made forty years ago, were claimed by this company, and, as to the owners of the Sawyer-Mann lamp, we know full well what success they have scored in showing the absurdity of the pretensions of this world-without-end incandescent company.

And hence it is that we would suggest to the publics of the other towns and cities in Maine, that before deciding to adopt the incandescent lights of this company that they would subserve their own best interests by carefully examining several other systems which are at least equally as good and can be had and operated for less money. We would particularly commend to them the United States system, using the Weston-Maxim lamp, and the Brush system, using the Swan lamps, the Schuyler system and the Consolidated. There is still another system of incandescent lighting, which, before long, is likely to make a name for itself, and this was invented and belongs to Dr. Moses.

The time for monopoly in electric lighting has gone by, and the discoveries in both arc and incandescent lighting are too numerous and ancient to permit of the establishment of any such claims.

THE UNDERGROUND CONUNDRUM.

There seems in some quarters to be a disposition to find fault with the members of the Subway Commission, on the one hand, for not instantly devising a means for burying the wires, and, on the other, for pressing the companies too closely at a trying time. Yet it would not be difficult to show that the members of the Subway Commission have offended neither in the one direction or the other. So far as we can see, the action of the Subway Commission has been marked by tolerance, good sense and excellent judgment. It is not their fault that the absurd law was placed on the statute books.

A certain portion of the popular press—the unthinking portion of which the *Times* is the leading spirit—demands that the Subway Commission at once discover a means of burying the wires, and then force the companies to adopt it. No one knows the unreasonableness of this demand better than the electricians and scientific men who have looked carefully into the matter. They, though seeking long and diligently, have not discovered such a means, and how preposterous, then, to expect it at the hands of the commission.

This commission is invested with power to command the electrical companies to bury their wires, but, being composed, as it seems to us, of reasonable men, they are not likely to insist upon this being done until they have found a plan which will insure effective work and good service when they shall have been buried. When they do select such a plan and issue the mandate, several things may happen. The companies may not agree with them that the plan they have selected will insure good service, and have them legally restrained from interference with the aerial lines until the constitutionality of the law may be looked into by the courts. Or they, or certain of them, may decide that they would rather discontinue their New York business than go to the expense of burying their wires in the way suggested.

This is a matter the commission have nothing to do with. It is for them to carry out the law to the best of their ability, and in the manner which to their minds seems likely to give the best results, and at that point their jurisdiction ends. What action the companies take can scarcely affect them either in one way or another. Yet, on the other hand, we cannot help expressing the hope that the moderation and good sense which have thus far characterized their actions will be continued to the end. The commission has discretionary powers—wisely included in the amendment to the original bill—and, if wisely used, perhaps they may be able, at least in part, to solve this very difficult problem, though we frankly confess we don't see just now how it can be done, and we have studied the subject for years.

Certain of the daily papers, especially those whose editors are not informed on the subject, seem never tired of citing the cases of Chicago, Philadelphia and Washington. In reality, these installations furnish little or no testimony that the thing is feasible on such a grand scale as would be necessary here. Washington is a small place when compared with New York. Where one wire is required there, a hundred are used here. The underground system there was paid for in great measure by the Government, and, if we had the United States Treasury behind us here, there would be little difficulty in burying the wires. So far as Philadelphia is concerned, what few wires run underground are of an experimental rather than a permanent nature.

The general public, and the organs from which it gets impressions, has a tendency to confound the possible and the practical, the laboratory experiments with the commercial success. It would have the companies expend millions in burying the wires, and at the same time furnish a cheap service. The companies, on the other hand, being run on business principles, have to look out for the cost of construction and operation. Their managers know that if they quadruple or sextuple the cost of plant they will be compelled to raise the rates for service proportionately, and they are aware that the public, being accustomed to cheap rates, can never be made to pay such exorbitant rates as they will be compelled to charge under certain conditions. Therefore it is that they seek a means of burying the wires which will be at once practical and inexpensive.

Much has been said about the Chicago underground system, and all those who know nothing about it wag their ample ears and pronounce it a practical and permanent success. But the fact is, the Chicago system is little more than a temporary means of keeping within the bounds of a stringent and, it must be said, an unreasonable law.

The inconsiderateness and unreasonableness shown by a certain portion of the press and the public, which is led by it, it is but charitable to regard as begotten of ignorance rather than maliciousness. If a business man were compelled by law to go to an unusual expense in carrying on his business, he would naturally enough charge the additional expense to the price of his goods and be justified in doing so, just as he now invariably adds the import dues to the price he demands for his goods or wares, yet the electrical companies are expected to make an enormous outlay for additional plant, and at the same time furnish a cheap service. This is unreasonable, to say the least.

We hope the telephone people will turn out in force next week to attend the Providence meeting, and that when they adjourn it will be to meet in this city next year.

GENERAL WESTERN NEWS.

A new feature in places of amusement has just been introduced at the Columbia (late Haverly's) Theater. The combination is the invention of Mr. W. C. Shaffer, of Philadelphia, Pa., an electrical inventor of considerable ingenuity.

The apparatus referred to has for its object the suppression of an incipient conflagration originating in a theater or other public building. A curtain of asbestos on wire netting, outside the ordinary drop curtain, remains rolled up in its normal condition. Electrically connected among the flies are the necessary auxiliaries for releasing the curtain on the first outbreak of fire. The curtain, which weighs 700 pounds, is balanced by a weight, and this, in turn, is held by a mere thread of a string, and when released the curtain will fall about thirty-four feet in six seconds. Its drop is also so arranged as to be governed by a thermostat connection. During the time occupied in descending the first foot it rings a vibrating bell, as a warning to the stage people, any one of whom, being in the line of its descent, will have abundant time to step out of the way. Shou'd the curtain be released by accident, the prompter has at hand a cord governing a brake, by which it can be stopped at any point in its descent. The matter of battery was something of a puzzle to Mr. Shaffer, who was desirous of some tell-tale by which the average stage employe could always know if the battery was up to its normal condition, and thus be able to keep the apparatus at all times in perfect order. A suggestion by a Chicago electrician settled that matter by placing a back connection relay in the circuit with the main current, of a proper resistance to let go before a dangerous weakening of the main battery, and by ringing a bell in a local circuit, connected through the back points of the relay, call attention to the failing battery before its weakness is liable to do harm.

Other connections in the same train, which is set in motion by the burning of the string, the closing of the thermostat, or the pushing of a button, open a reservoir of water over the stage, open a trap in the roof to create a draft away from the auditorium by a revolving fan over the stage, open all the exits of the house, and finally ring a fire alarm.

Mr. Shaffer has all this in a very neat and compact working model, with which he exhibits the working of the combination. To show this to the management of the Columbia was all that was necessary for its adoption, and the work is now in complete operation. Long before a fire upon the stage could by any possibility work harm to the spectators, the entire audience might be marched out to funereal music by the orchestra, and those gentlemen have plenty of time to pack up and retreat in perfect order afterwards.

The introduction of burglar alarms in private dwellings is becoming the rule in Chicago. Being a city of cosmopolitan population, and withal the seat of much wealth, there is excellent opportunity for light-fingered gentlemen of enterprise to ply their nefarious trade in all the forms known to rascality. The Police Signal and Telephone Company's combination of alarms has done much to discomfit this class of industry by placing it within the power of any good citizen to call a police force at any street box, with a certainty of a response within two minutes. Telephone wires entering a residence are a pretty sure safeguard against depredation, for the thief or burglar has no means of knowing to what class of alarm these may belong. In addition to this, placing of a burglar alarm, which rings when a door or window is surreptitiously opened, renders it almost certain that the party attempting the outrage will have left the premises before the inmates can reach the opening.

The burglar alarm sometimes plays some laughable pranks, however, one of which created considerable consternation in the household of an electrician here not long ago. The gentleman in question retired at night before the good wife, who, of course, tried all the doors and windows before going to bed. The window stops in this case are arranged so as to allow either sash set at any particular height, while leaving the alarm intact. The night was quite warm, and the cool wind which sprang up about midnight finally blew open an inner hall door, ringing the alarm and startling the entire household. Instantly the house was filled with scantily-attired ghosts of both sexes in search of the intruder, who, of course, was not taken. But the funniest part of the farce is found in the fact that not one of the investigators had so much as a broom with which to oppose the unknown villain, yet the head of the household is stronger than ever in his faith in burglar alarms.

A severe thunder storm occurred early on the morning of the twenty-first instant, vivid lightning and loud rolling thunder accompanying a very heavy rain storm. A fierce flash struck a four-story building on Michigan street, corner of La Salle avenue, occupied by Obern, Hosic & Co., dealers in hides, felts, etc., destroying a large stock of goods and the building. The building was completely fired, and the work of destruction so sudden and thorough that the alarm, turned in as soon as possible, had not sounded before the blaze was well under way. A high pole line in front of the building filled with telephone wires, was destroyed, about forty wires being lost. The building and stock were fully insured, and the loss is said to be about $40,000 to $50,000. The fire, which took place about 3.30 A. M., seriously disturbed the slumbers of two watchmen who were said to be sweetly sleeping in the second story at the time.

Mr. Nector Rousseau, assistant superintendent of construction of the Chicago Telephone Company, was made the recipient of a handsome first class Elgin watch the other day, by his associates and other members of the church in which he is enrolled. The case, a very neat gold one, bears this inscription in French :

"Presented to Nector Rousseau, by his friends of the Church of Notre Dame, Chicago, 1885."

"Nick" is abundantly proud of his new watch, which was well deserved of his many friends.

Something like six months since, the Chicago Telephone Company rearranged some of its departments, and the repairs, inspection and construction were all blended under one head, that of the superintendent of construction, Mr. J. W. Brennan, at his own suggestion, plenary powers being given him to seek out causes for the poor work, which some of the lines and instruments were doing, and which had for some time been the source of no little trouble.

Inspectors would report a line and the instruments all in order, and for ought they were enabled to see, they were still in every-day work, in the hands of subscribers, these did not work satisfactorily.

Experimenting with galvanometers showed in the majority of instances a wide discrepancy in the resistances of the instruments, both receivers and transmitters. Following up the hint thus obtained, changes in these were made, with the best possible results.

To further illustrate the cause and effect, the following is given: A line 25 miles in length was built for private parties, which, when completed and furnished with instruments, worked so unsatisfactorily that the parties refused to accept and pay for the line. The inspectors declared the line and instruments all right, but, nevertheless, it would not work.

Then, under instructions from the superintendent, the galvanometer man tried his hand at the puzzle, and found that the coils of the transmitters measured respectively 120 and 180 ohms, and the receivers 50 and 60 ohms.

The receivers were ordered exchanged for two of 100 ohms each, and the transmitters for two of 300 ohms each, and the trouble was over at once when the change was made. The line worked like a charm.

The same result was accomplished by similar treatment in a case where three private lines worked indifferently well, these being the property of one firm, where indiscriminate connections are desired. In this case by making the transmitter coils of the same resistance, and equalizing those of the receivers, the difficulty was instantly removed.

During the six months tests were also made of line resistances, these being connected through from one office to another, or through the second to a private telephone station. In the same district wide differences were found, and four lines selected in each of eight offices showed an average of 1,033 ohms, which includes line, two instruments and switch-board connections.

Several of the outside branch offices were connected because of their extreme distance, and a difference of over 1,100 ohms shown between the resistances in local and long lines. Tall lines have also been thus scrutinized. The result of all this work of Mr. Brennan has been tabulated, and, without going into further particulars, the grand result is given below:

Resistance taken out of lines, bad connections etc., during six months	49,032	ohms.
Instrument resistances reduced	11,816	"
Ground-wire resistances reduced	64,737	"
A total of	125,585	"

or, the equivalent of 3,805 miles of No. 12 iron wire, and the good work is still going on. Mr. Brennan has certainly to be congratulated on the results obtained, which are all in accordance with the law of Ohm, so often ignored by telephone people.

Another competitor has just entered the arc-light field. Mr. F. C. Hydel, representing the Schuyler system, has opened out, commencing with an eighty-light central plant on State street.

Both inside and outside lights will be included in the above.

The annual changes preparatory to the yearly Industrial Exposition, are being made, and parties have commenced stringing wires for electric lights. From present appearances there will be a very general display and variety of both arc and incandescent systems, some motors, too, and not unlikely plenty of tribulation for the city inspector, as usual. This gentleman holds temporary work to be an abomination, because from the brief life of such plants the parties installing them are hurried, and consequently lax in their methods of wire-running and insulation. The building, too, is an unfavorable one, in that the atmosphere is continually moist because of the waste steam which escapes from the engine department; and, in addition to this, the spray from the central fountain cools the building by filling the air with spray globules, which settle like dew upon everything in the upper parts of the building. This, taken in connection with the fact that every truss rod in the building from which arc lights are suspended is a good ground, and the floor, hardly separated from the moist earth beneath, renders it quite difficult to keep a circuit in good condition except through extreme care in installations and constant subsequent watching.

One of the most enterprising animals known to naturalists is the common rat; and his efforts are accompanied and directed by considerable intelligence How he manages to know for what purpose a lead pipe in a building is placed, is a mystery; yet, when driven by thirst, the scamp will gnaw a hole in a water pipe to get a drink, and then, like many another of his mental superiors, he lets the "other fellow do the walking," and mend the hole when he gets ready.

What object a rat has in gnawing a paraffined wire is beyond human ken; yet they do, and that not infrequently. In the *Pioneer Press* building at Minneapolis, the rats have make lots of fun for the firemen. Portions of the thermostat wires had been bared by the mischievous animals, and the two wires have been several times crossed by them in their gambols, in each case turning in a false alarm. Chief Jenkins finally discovered the cause, and a re-insulation of the wires a few days since put an end to the annoyance.

The Cincinnati *Commercial Gazette* of the 23d ult., in reply to a communication asking why wires are not put underground in that city as well as in others, assumes, with a great show of pompous wisdom, that "the true reason why wires are not put underground is because there is no system that is efficient for placing them there and keeping them in good order."

Is it possible then, that Chicago, Philadelphia, New York, Detroit and other cities, after carefully canvassing the matter pro and con for so many years, are making the fearful mistake of allowing their streets to be torn up, either past, present and prospectively, for this purpose, when the Cincinnati solons have declared that the work is to be futile in the end?

Does the editor-professor of the *Commercial Gazette* realize the fact that Chicago's electrical wires of whatever nature, any and all of them, which enter the new City Hall, come to it underground. That the police telegraph, the alarm lines of the fire department, the striking wires, time wires, and all the telephone lines from the several police and fire stations, are all underground at that place; and that for nine years a half-mile of underground wire has been in perfect, constant operation in Chicago, without a dollar being expended for repairs; and that all the above lines running to the City Hall have been so running since October, 1884, and so thoroughly satisfactory has the service been that all of the city's wire plants in the south division—an area of two and one-half miles square, or about six and one-quarter square miles—will all be down, buried in the Dorsett conduits, before the average country editor has killed his hogs and made his cider, if indeed they are not out of sight before he digs his potatoes.

The editor likes the overhead cobwebs. "We do not regard the wires as disfiguring. The immense number of them that pass over and around the *Commercial Gazette* make known clearly the fact that it is in a very busy and alert part of the city. They serve as good real estate pointers. They are doing very well. They are the clearest testimony of an advanced and prosperous civilization. Let them alone." There are divers ways of designating business centers in different localities. In the absence of guide boards and finger posts perhaps the wires are as good as anything for the purpose of designating the place where

> "The editor snores in his barrel chair,
> Assistants, scissors and paste-pot near;
> Where rampant horses and jacks adorn
> The dingy walls of the sanctum drear;
> And the grim cob pipe with its rank perfume
> Has scented the dreamy half-lighted room.
> Yet the editor deems his oracular pen
> A guide for the great world's greatest men."

On the 28th inst., articles of incorporation were issued by the Secretary of State of Illinois to P. M. Adams, M B. Mills and J. L. Campbell, of the Minnesota & Illinois Telegraph Co., at Chicago.

Mr. C. D. Shain, the agent here, announces that the Stanley Lamp and Thomas Cut-out Combination System is now thoroughly on its feet as a system prepared to battle for its portion of western patronage. The company are ready to furnish all sizes of dynamos and complete systems to customers.

And that reminds me that the Schuyler folks have come also, and established an agency here. The arena is well filled, but there is a sort of india-rubber pliability to the enclosure which will still admit of all new comers. The field is large, and, as yet, uncrowded.

Telephone stocks at Lynch's Exchange are quoted as follows:

Central Union	.56 @	.58
Michigan	.68 @	.70
M. & K.	.55 @	.57
United	.15 @	.18
Great Southern	.50 @	.53
Chicago	$375.00 @	$400.00

CHICAGO, Aug. 31, 1885.

Telephonic News

⁂ There are 900 private telephone wires in the city of Boston, three-fourths of which belong to the telephone company.

⁂ The Bell Telephone Company, of Philadelphia, have just strung 6,000 feet of 100-wire Patterson cable in that city.

⁂ A recent severe storm in Kansas City, Mo., severely affected the telephone service for a day or two. Some five or six poles were splintered, a score or more of magneto-bells were burned out, and wires were broken and crossed quite generally. The damages occurred in the outlying district, where there were no lightning rods on the poles. During the storm a sewer in the city caved in, leaving a large hole in the middle of the street some sixty feet deep.

⁂ The Prince Edward Island (P. Q.) Telephone Company has concluded the purchase of the patent rights and all the property of the Bell Telephone Company in that island. The amalgamation thus effected will enable the Prince Edward Island Company to establish trunk lines, as well as exchanges, connecting all the principal towns and villages throughout the island; and the subscribers will soon be able to sit down in their offices or houses and have a quiet chat with friends and others in Tignish and Alberton, Souris and Gagetown, Summerside and Mt. Stewart.

⁂ The American Bell Telephone Company has made concessions to sub-companies aggregating about $200,000 per annum, which must be deducted from the parent company's income for the current year; but the concessions will, of course, add materially to the earnings of the sub-companies. The new rates charged the sub-companies by the Bell Company are as follows: Net rentals for each telephone and transmitter per year—Exchange subscribers paying $24 per annum, or less, for exchange service, $3; exceeding $24 and not exceeding $27 per annum, $3.12½; exceeding $27 and not exceeding $30 per annum, $3.37½; exceeding $30 and not exceeding $33 per annum, $3.87½; exceeding $33 and not exceeding $36 per annum, $4.50; exceeding $36 and not exceeding $39 per annum, $5.25; exceeding $39 and not exceeding $42 per annum, $6; exceeding £42 and not exceeding $45 per annum, $6.75. Where subscribers pay above $45 per annum, present net rentals will stand. Where the present contract relations and discounts give a less net rental than the net rental herein named, the present contract will be followed.

⁂ Within the limits of the city of Brooklyn the New York and New Jersey Telephone Company have 2,500 subscribers, besides over 150 in Flatbush and other suburbs. They have 3,300 miles of wire strung along nearly eighty-five miles of streets. The company have proposed to bury the lines in certain streets, such as Washington, from Myrtle avenue to Prospect street; Fulton street, from City Hall square to Raymond; and Flatbush avenue, from Fulton street to Third avenue. They intend to use a creosoted wooden box, divided into compartments, in which will be placed cables of 25, 50 or 100 wires. The box is laid in a trench 30 inches deep, with manholes at convenient intervals. They have furnished the Underground Wire Commission with maps showing the location of all the poles and subscribers. It is thought, if the company consent to use hard copper wire, instead of iron wire, the number of poles in the crowded parts of the city may be reduced one-half. The Western Union Telegraph Company, with their 540 poles in Brooklyn and 181 miles of wires, have expressed a willingness to agree to the plan which may be finally adopted for the wires of the New York and New Jersey Telephone Company. For fire-alarm purposes about 200 miles of wire are now in use in Brooklyn.

⁂ The output statement of the American Bell Telephone Company for the month ending August 20, shows that 544 more telephones were returned than were shipped.

⁂ The Fisher's Island Telegraph Company of New London, to buy, own, sell and operate telegraph and telephone lines; capital stock $4,000, in shares of $25 each, has been organized in the State of Connecticut.

⁂ The Bell Telephone Company, of Buffalo, has agreed with the Lockport (N. Y.) authorities by which the company receives all desired rights of way, etc., by furnishing free of charge three telephones for the use of the city. The fire-alarm poles, owned by the city, are leased to the telephone company for nine years.

⁂ Manager Guireand, of the Mexican Telephone Company, has accepted the position of general manager of the Pueblo Telephone Company, of Mexico, in which capacity he will serve, and still continue as chief officer of the Mexican. Mr. C. B. Cummings, of Boston, is secretary and treasurer of the Pueblo Company.

⁂ A decision in the case of the Domestic Telephone Company against the Metropolitan Telephone Company, of New York, has been rendered by Vice-Chancellor Bird. The Newark Company applied for an injunction to restrain the New York Company from interfering with their plant pending the Chancellor's decision on an application for a mandamus to compel the Metropolitan Company to renew their contracts for the exclusive use of the Bell instrument in this city. The injunction was granted.

⁂ The telephone subscribers of Salem, Mass., have been notified that on and after September 15, 1885, there will be an increase in the rental of the instruments. This announcement has caused something of a breeze in the usually placid city. It is proposed to lower the monthly tariff on instruments in residences from $3.60 per month to $3.33, and to raise those used in business from $3.60 to $4.17. Where a subscriber has instruments both at residence and place of business, the present price would be $7.20; under the proposed rates it will be $7.50.

⁂ A Wilmington paper contains quite a review of the trials and tribulations of the night "telephone boy" of that city. If the young man does all the work that "Fair Play" gives him credit for, he is certainly a valuable attache of the telephone system. His duties "include every night in the week, beginning at 6 o'clock and 9 o'clock on alternate nights and closing at about 8 o'clock A. M., with a day tour of duty extending from 11 o'clock A. M. until 2 o'clock P. M., with occasional demands for other kinds of work, such as bill distributing and collecting."

⁂ There is an underground wire company in Detroit, Mich., composed of Francis Palms, M. W. O'Brien, John Collins, W. S. Armitage and other gentlemen connected with the Galvin Brass and Iron Works, of that city. The system is the invention of Galvin Bros., and is spoken of by one member of the company as follows: "We claim to have a system, new in principle, much superior to any other in use. We think we shall be able to put in half the space four times as many wires as can be put in by the Dorsett process. Our plans are not yet complete."

⁂ Superintendent Miles has reported to the Commissioners of the District of Columbia that all the District wires could be taken from poles and house-tops and placed in underground conduits for $25,000. He asks for an appropriation of this amount for this service. He makes this suggestion in advance of his annual report in order to give opportunity for an early consideration of the subject. In another report he urges that printing telegraphs be substituted for telephones in the police service, and advises the purchase of twenty of these instruments. An instrument that can talk is, in nearly all circumstances, superior to all others in giving alarms and calls, and the commissioners would do well to carefully investigate before adopting the above suggestion.

⁂ Superintendent Parker, of the New England Telephone and Telegraph Company, Boston, has the following to say concerning the private line trouble in that city: "The company has decided, after some consideration, and not without reluctance, only to lease wires where they can control them. This is not so much for the reason of the profit which might accompany the handling of the lines, but because irresponsible parties have been building them, who have neither fixtures nor poles with which to run the lines, and so almost invariably use our attachments in many cases our lines, cutting out our subscribers. We have a complaint from a subscriber now, on investigating which we found that his wire has been taken for a private wire. This is no reflection on the people who cause the wires to be run, and I am not surprised at the view taken by many, when they do not fully understand the facts of the case. The trouble is, they employ any man who comes along who can run a line, and the men employed are sometimes discharged employés of ours, perhaps discharged for cause, dishonest conduct, or something of that kind. These men go to owners of buildings and get permission to go on the roof in the company's name, and, when there, fix their wires to our fixtures, and in many cases steal our wires and cut out our subscribers. I have known a spare conductor in our cables—a very expensive thing—to be used for a private wire. We found there was no other way to end the annoyance than the one we have adopted, and we were absolutely obliged to take the step. I do not mean to say that all the men who build lines are of the class I have mentioned. We have an entirely distinct and separate force of men to take care of the private wires; they have nothing whatever to do with the exchange business, and we are prepared to maintain the lines at as low a price as any one else, but we cannot compete with men who take out our lines. In cases where we have notified parties, we have offered to duplicate their bills. We believe this is the only way in which we can reach the evil, for such it has become."

⁂ An unfortunate affair in Lawrence, Mass., resulted in the death of Albert D. Swan, formerly general manager of the Molecular Telephone Company. The killing was done by Henry K. Goodwin, who shot Mr. Swan in his office in Lawrence. Developments show the difficulty between Goodwin and Swan to have been over a patent telephone switchboard invented by Goodwin. The friends of both state that when the switchboard was invented Goodwin went to Swan for financial backing. The latter gave it to him and a patent was applied for in the name of Henry K. Goodwin, assignor of one-half interest to A. D. Swan. Swan is said to have neglected to make the final payment at the Patent Office, and before a new patent could be applied for Waite & Bartlett, of New York, manufacturers of the telephone instruments used by the Molecular Company, applied for a patent covering the same ground. Swan had previously sent Goodwin to these parties for advice in the matter of his invention. Finally the matter was adjusted by Goodwin, Swan Waite & Bartlett taking the patent together. Goodwin's friends say that Swan's carelessness in not taking out the patent led to the loss of $40,000 to Goodwin, which had been offered him for his invention. The switchboard, when patented, was found not to work satisfactorily, and Goodwin refused to fix it, and no one else could do so. Goodwin thought that Swan had prevented him from getting work in various places where he had applied for it in order to force him to put the switchboard in working order. Goodwin had just made a three weeks' trip through Canada and the West in search of work, and although he is a capable electrician he could find none. He came home discouraged, and probably brooding over the imaginary wrong done by Swan and determined to kill him. Swan's friends say he was the best friend Goodwin had. Several times he obtained positions for him, and they were apparently on the best terms with each other, always joking, and even the morning of the day of the shooting talking together pleasantly. The defence will undoubtedly be insanity.

Trouble in the New England Telephone Company.

BOSTON, Aug. 31st.

Editors of the Electrical Review:

The daily papers, especially the *Herald*, has given considerable space to telephone matters during the past week, and especially to the New England Company. Firstly, the *Herald* has been trying to figure out the New England Company's ability to pay a dividend in October, which some of their correspondents doubt, though the financial writer of the *Herald* thinks it possible, from figures published of the earnings for January, February, March, April and May—five months—which show about $75,000 above all expenses, or some $15,000 per month; that the company can pay nearly four per cent. per annum, allowing something for increased earnings. But parties who are familiar with the New England Company's business for the past six months have but little hope of an earned dividend in October. A gentleman, well up in telephone matters, assured me to-day that the five months above quoted showing about $15,000 per month will hardly be equaled again this year; that during that time construction was almost entirely stopped, that only repairs of necessity were made, and that the most rigid economy was practiced in all departments, in fact, so much so, that he has no doubt the next three or five months will not show over one-half the net earnings that the previous ones did.

By the way, where is the June report of earnings? May showed a falling off; but was June so bad that they are keeping it back?

Regarding the increase of earnings which its friends claim, where are they coming from? Evidently not from new subscribers, for I very much doubt if the company has held its own for the past three months. But they say they are increasing rates! This is likely to lose more subscribers, and there is considerable doubt if the company dare to make a raise except in a few isolated cases. Take for instance Springfield and Holyoke, Mass., two large cities and two large exchanges, having free communication with each other and neither place getting hardly an average price for its subscribers, say nothing of the free service between the two cities. If they really intended to raise rates equitably, it would seem they would commence in some such place as this instead of a small town in New Hampshire, or a place like Peabody, Mass. However, time will show the wisdom of the Bell company's policy as regards the New England. I, for one, doubt it, and until the management is taken entirely out of the Bell Company's hands the New England Company will neither be successful or popular with its patrons.

The Sunday *Herald* has a two-column article regarding the forcing of owners of private lines to give up their lines to the New England Company; and not have any rights to them except as lessors. Some of the largest business houses and corporations have objected thereto, and still own and hold their lines, while a large number of smaller firms have been driven into giving up their lines to the New England Company.

The following portion of the *Herald* article shows how the matter stands:

"In business circles in Boston, more especially among those merchants owning private telephone wires, quite a little stir has been occasioned by the alleged arbitrary action of the New England Telephone and Telegraph Co. A large number of Boston merchants have, at their own expense, erected wire communication between their offices, stores, etc., and their wharfs, warehouses, etc., at the same time leasing their telephone instruments from the telephone company, which now claims the exclusive right to rent instruments in New England. The owner of each line has employed an electrician of his selection to keep his lines in repair. As rapidly as a lease of telephone instruments, attached to private wires, lapses, the telephone company notify the lessees that in the future they (the telephone people) will assume the care of all aforesaid private lines, and, if this privilege be refused them, they will at once remove their instruments and telephonic

service be absolutely refused. Such being the status of affairs, the private wire people have vigorously demurred, some actually refusing compliance, while others, feeling that their business would suffer materially from the loss of telephone service have succumbed. There are many, however, who, doubting the legality of the demands made by the company, propose to test the question through the light of legal proceedings."

Raise in Telephone Rates.

Over one hundred business men, representing three hundred who use telephones in Pittsfield, Mass., held a meeting Tuesday evening to take some steps to resist the increase in the price of telephone rents, which they have been notified will take effect September 1. Assistant General Manager Denver was present and repeated statements similar to those made in Salem recently, and which were printed in the *Mail* the day following. At the Pittsfield meeting it was shown that his statement of unprofitable business did not tally with the last report of the company to stockholders, May 1, 1885, which gave "net earnings for nine months to December 1, as $161,215; operating expenses, 76 per cent. of the gross receipts, and a handsome net gain expected each quarter." There is a striking difference in statements from the Bell Company (in behalf of the New England Company) when they address themselves to stockholders, from what is claimed when they are speaking to subscribers, as witness from their last annual report to New England stockholders:

"In conclusion your directors would say that your property is in much better condition than it has been at any time since the organization of the company. The large sums expended in construction, reconstruction and repairs during the last nine months will very materially reduce the sums needed for those purposes for the coming year, and your directors believe that we will be able to show a very handsome increase of earnings above all disbursements. The increase of your revenue from added subscribers, extra-territorial earnings, special lines and other sources, is likely to be slow but substantial. We think it safe to predict that after July we will be able to show such an excess of earnings above all expenses as will make it possible to pay a dividend to the stockholders."

On the contrary, this telephone missionary, Denver, says the company is heavily in debt, that the directors have decided that the company is barely paying expenses, that telephones were costing the New England Company $44.13, in short, that the only salvation for the New England and its stockholders is this same raise in rentals. Before this representative of the company addresses himself further to subscribers he should be furnished a copy of the last statement. He should further know that the Boston financial columns to which he referred his hearers, within one week have in a semi-official announcement, stated that the annual net earnings were $300,000, that the debt of the company was merely nominal, and that they were justified in paying 3½ per cent. Mr. Denver should be called in and recharged — *Lowell Exchange.*

On the Kicker's Desk.

The telephone company in Cincinnati, in order to accommodate captious subscribers who are always "kicking," has what is known as a kickers' or "K" desk. When any subscriber becomes obstreperous for any length of time, his line is disconnected from its regular position and placed in the "K" desk, where an expert operator, chosen especially for her good nature, takes charge of it. In connection with this the following little incident is related:

Last week a prominent business man and politician became curious as to the manner in which his telephone was worked and called at the office of the company General Manager Stone courteously showed him to the operating room and explained the working of the system to him in a satisfactory manner. Incidentally he showed him the "K" desk.

"What's that for?" asked the visitor.

"That is where we keep the kickers and growlers; fellows who are always objecting and finding fault about their telephones," answered Manager Stone.

"Oh, yes; excellent idea, very good," rejoined the visitor.

They turned away and looked at other things in the exchange, when the visitor suddenly asked:

"Where's my line?"

The manager turned to the check-boy and asked him the location of Mr. Visitor's line.

"No. 5555, sir," piped the boy, "it's over there on the 'K' desk."

The general manager came down the fire-escape for safety.

Circular.

NATIONAL TELEPHONE EXCHANGE ASSOCIATION.
SECRETARY'S OFFICE, No. 397 FULTON ST., BROOKLYN, N. Y., Aug. 25, 1885.

As notified by previous circular from this office, the seventh annual meeting of this association will convene at the Narragansett Hotel, Providence, R. I., on Tuesday, September 8, 1885, at 10 30 o'clock A. M.

Arrangements here have been made for a reduction of 50 cents per day from the regular rates at the above hotel. The charges to delegates will therefore range from $2.50 to $4.50 per day for board and room, varying according to the location of the latter. Mr. A. C. White, Superintendent Providence Telephone Company, will cheerfully attend to securing rooms in advance for any delegates who may request him to do so.

It is expected that the business of the session will occupy Tuesday, Wednesday and Thursday A. M, and that the afternoon of Thursday and the entire day Friday will be devoted to social entertainments, the nature of which will be made known at the business meetings.

The majority of the delegates from New York, and those whose route takes them through that city, will leave by the steamer of the Providence line from Pier 29, N. R., foot of Warren street, at 5 P. M. Information as to rates may be obtained, and staterooms secured in advance, by addressing C. H. Barney, of the committee, 259 Washington street, Jersey City, N. J.

WM. D. SARGENT, Secretary.

HENRY HOWARD,
C. H. BARNEY,
EUGENE F. PHILLIPS,
J. W. DUXBURY,
A. C. WHITE,
Committee of Arrangements.

JERSEY CITY, August 25th, 1885.

DEAR SIR:—I have arranged for special rates from New York to the Telephone Convention at Providence, R. I., and return; leaving New York on Monday evening September 7th at 5 P. M. by the steamer of the Providence Line from pier 29 N. R., foot of Warren street.

Most of the delegates from this vicinity will take this pleasant route. Should you desire to join the party I will cheerfully procure your ticket at the reduced rates, and hand it to you at the boat; also secure your state room upon receipt of your request to that effect. State rooms $1 and $2 each, according to location; each room having an upper and lower berth.

Yours truly,
C. H. BARNEY,
For the Committee of Arrangements.
259 Washington st., Jersey City, N. J.

.... The International Telegraph Conference has approved of a proposal embodying a modification of the Bismarck proposal which was rejected the other day. The latter called for a uniform rate of 4 or 5 cents per word for telegraph messages sent to and from places within Europe. The proposition now approved is for a uniform tariff on telegrams between terminal points which are in Europe, and on telegrams in transit in Europe and from points outside, but at rates considerably higher than those advocated by the German Chancellor. Germany's efforts, however, to have the cable tariff to and from countries beyond Europe, especially to India, China and Australia, materially reduced from the present high rates, are likely to prove successful. The modified tariff is 10 centimes per word in large States, and 6½ centimes per word in minor States.

.... The International Telegraph Conference at Berlin has decided that part of the address of a telegram or a cablegram indicating the destination of a message shall be counted as one word, even in cases where it contains more than a single word.

.... A district messenger boy left the office on Broadway and rushed madly for a Third avenue elevated station. He looked like a blue streak. The unusual occurrence created a great commotion, and a large crowd gathered at the office to learn what dreadful accident had happened. When it was discovered that the boy had gone to deliver a message at the Polo Grounds while a game was being played the crowd rapidly dispersed.

.... The whirligig of time has brought Jay Gould and Edward Stokes into bitter antagonism. In Stokes' troubles with the Erie railroad under the Fisk-Gould regime, in relation to his oil contracts, Gould was always understood to be his friend at court Now, as president of the United Lines Telegraph Company, Stokes will attack his old friend in his Western Union stronghold. It is generally understood that the California millionaire, Mackay, is the capitalist in the new telegraph company, and, as far as financial rumors go, he is certainly the most formidable opponent Gould has ever encountered. It is understood that Mackay, is thoroughly enlisted in the fight, and will wage a bitter war for cheaper telegraph rates.

.... On the 6th of August the Baltimore and Ohio Company's employes were attacked while endeavoring to plant certain poles in the city of Syracuse, and the work stopped and telegraphic communication interrupted. Upon this, suit was brought by the Baltimore and Ohio, which resulted in an injunction being continued against the disturbers by Justice Kennedy, who quoted the following provisions of the State law, which is a law that our Underground Wire Commissioners will do well to read carefully: "In 1848 an act was passed entitled 'An act to provide for the incorporation and regulation of telegraph companies.' By the fifth section of this it is provided that such association - telegraph company organized under the act—is authorized to construct lines of telegraph upon and along any of the public roads and highways, or across any of the waters within the limits of this State, by the erection of the necessary fixtures, including posts, piers and abutments, for sustaining the cords or wires of such lines, provided the same shall not be so constructed as to incommode the public use of said roads or highways, etc.' In 1853 the above section was amended so as to read: 'Said association is authorized to erect and construct, from time to time, the necessary fixtures for such lines of telegraph upon or under any of the public roads, streets and highways, and through and across or under any of the waters within the limits of the State, subject to the restrictions in said recited act contained (such restriction is that such erections shall not incommode the public use of said roads, streets or highways), and also to erect and construct such fixtures upon, through or over any lands, subject to the rights of the owner thereof to full compensation for the same.' By chapter 491 of the laws of 1870 it is provided that 'Any person who shall injure, molest or destroy any of said lines, posts, piers or abutments, or the material or property belonging thereto, shall, on conviction thereof, be deemed guilty of a misdemeanor, and shall be punished by a fine not exceeding five hundred dollars ($500), or imprisonment in the county jail not exceeding one year, or both, in the discretion of the court before whom such conviction shall be had The further to emphasize the security with which the law surrounds structures of this kind, the additional provision is made: 'In cases when from necessity, by reason of the removal of houses or other like causes, the said telegraph lines are interrupted, broken or interfered with, if the person causing such interruption shall have given twenty-four hours' previous notice in writing to any agent of the company to whom the lines belong, he shall be exempt from the penalty herein provided, and not otherwise.'"

TELEGRAPHIC

.... The estimated traffic receipts of the Direct Spanish Telegraph Company for the month of July, 1885, were £1,360, against £1,501 in the corresponding period of last year.

.... The manager of the United German Telegraph Company gave a banquet to the delegates to the International Telegraph Conference, at Berlin. Many persons distinguished in Berlin official and social circles were present.

.... Mr. John G. Farnsworth, as receiver of the Bankers and Merchants' Telegraph Company, has brought suit against the Western Union Telegraph Company to recover $2,000,000 damages. The plaintiffs allege that on July 10, while they were in quiet and peaceful possession of their property, which consisted of a complete system of telegraph in this and other States, and were carrying on and conducting their business, the defendant forcibly and with malicious intent, and with the view of destroying their system of telegraphy, entered upon their property, cut and detached wires and cables, and took possession of and removed wire cables and telegraph instruments, thereby impairing, and in many instances destroying their business, and inflicting great injury to the value of their system. Dwight Townsend, Secretary of the Bankers and Merchants', said that their company was left helpless for ten days by the action of the Western Union. Not only their wires were cut, but the wires of the American Rapid as well. People who were in contract with them were obliged to withdraw their agreements and give their patronage to the Western Union Company. It was a blow to their reputation as a telegraph company, and the consequent effects had been bad. Now they intended to make the Western Union folks pay dearly for their mischief. Col. Robert J. Ingersoll, Lauterbach & Spingarn, and Henry J. Schenck will wage the fight against the Western Union.

.... The project of building a telegraph line from Minneapolis to Duluth has lately been revived, with a fair prospect that the movement will take definite form. The business of the commission men in the two cities has always been impeded more or less by insufficient telegraph facilities. The Chamber of Commerce needs almost constant communication with Chicago and Duluth during its sessions, yet it is impossible to secure frequent reports, except at exorbitant prices. At present the chamber receives reports from Duluth only at intervals of fifteen minutes. The service of the Western Union and its heavy rates led to the agitation of the question of an independent line several months ago. At that time the company reduced its charges from 40 cents to 25 and promised better and more rapid accommodations. The service, however, has never been satisfactory, and of late its insufficiency has been a sore drawback. Leading grain and elevator men in Minneapolis and Duluth are now quite determined that the new line shall be built. It was announced that capitalists of that city stood ready to advance the money needed for the enterprise, and that an informal meeting looking to the formation of a company had been held. Leading chamber of commerce men stated the other evening that the project would undoubtedly be put through. Arrangements are also in progress having in view the extension of the Baltimore & Ohio Telegraph line to this place from Milwaukee, its present north-western terminus. By some it is asserted that this will not be done immediately, but that with the completion of the Wisconsin Central's Chicago extension an era of close traffic relationship between that road and the Baltimore & Ohio will begin, and that a feature of their compact will be an extension of the latter's telegraph lines to all points reached by the Wisconsin Central. The Chicago extension of the Central is under contract to be completed by December 1st,

ELECTRICAL AND SCIENTIFIC

* * The Bell mine, in Montana, which produced about 4,000,000 pounds of copper last year, has closed. On the other hand, the Old Dominion, in Arizona, is to be started up to furnish furnace material for the Baltimore works.

* * A good deal of attention is being given to Lower California as a copper mining region, and some of the many rumors current as to the intentions of cer ain companies to begin operations there are pretty likely to have foundation.

* * An electrical expert has devised an apparatus for the automatic steering of vessels in which electricity and compressed air are the main agents. The apparatus is said to be capable of being worked from the bridge, "once the vessel is set on her course," and it is announced that it will be given a trial on the Tallapoosa.

* * Permission has been given an agent of the Bentley-Knight system for propelling street cars by electricity to operate his system upon a section of the Metropolitan tracks on Huntington avenue, Boston. The consent of the city authorities has been obtained for tearing up the road to lay the conduit, which runs between the rails and contains the conductors.

* * The expenditure of Europe in armaments amounted last year to £183,519,997. Russia is easily first with a total of more than £46,000,000. France is second, with more than £33,500,000; Great Britain third, with nearly £31,500,000; and Germany fourth, with over £22,500,000. France is first with a national debt of over £960,000,000; Great Britain second, with over £758,000,000; Russia third, with £603,500,000; and Spain fourth, with £501,000,000. This is a surprising prominence for Spain, which has an annual expenditure of only £35,000,000, and a military expenditure of only £6,250,000. As for Germany, her debt is a comparative trifle.

* * In order to make the reading of weathercocks and wind vanes more convenient from a social point of view, Mr F. M. Rogers, of Finsbury Pavement, London, has devised an electrical indicator attached to the main weather vane, which reproduces the movements of the latter indoors; that is to say, in a house, office, or observatory. A dial, having the points of the compass engraved upon it, is traversed by a rotating needle, which is actuated by coils in circuit with a battery and the weather vane, which controls the current by its movements in such a manner that these are imitated by the needle at a distance. The apparatus is on view at the International Inventions Exhibition, and from the variety of purposes to which it can be applied (meteorological as well as practical) it ought to be very useful

* * Engineer John Teller, of the Utica and Black River road, relates the following experience during an electric storm: "As we pulled out of Trenton at 9.42 P. M. the lightning began darting around the engine and tender so constantly and vividly as to make the effect blinding. I could see nothing, and did the best I could. We ran four or five miles very slowly, expecting every moment to be struck. The ground and tracks about the engine and cars seemed to be covered with electricity. One bolt descended between the tender and the fence at the roadside, but exploded before reaching the ground, leaving behind it a smell of brimstone almost suffocating. It was the first time in my experience that I ever felt like leaving my post. Among the passengers, ladies tied their handkerchiefs over their eyes to shut out the blinding lightning. Freight trainmen report seeing many fires along the line of the road, undoubtedly set by the lightning. The hail was very heavy."

The Physical Philosophy of the Future; or, The Universal Force Electrical.

By Henry Raymond Rogers, M. D., Dunkirk, N. Y.

The problem of the universal force has occupied the profoundest intellects since the birth of Science. Yet, notwithstanding, it remains as deep a mystery as ever what gravity, sunlight, sunheat, etc., are in their essential nature, how they are generated, and how their functions are performed.

In the days of the past the data sufficient for the construction of a true philosophy of the physical universe were wanting, and all the great cosmical phenomena were naturally and necessarily explained in a superficial manner. Observations were limited and crude. Few or no instruments of scientific precision existed. Fact and fiction, history and mythology were hopelessly intermingled. All methods of investigation were uncertain, and the superficial appearance of things chiefly governed the theories that were invented. These early theories, of necessity unreliable, by perpetuating themselves in the form of traditions, held the great minds of succeeding generations; nor are they without a controlling influence on science, even at the present day.

But a new era is clearly approaching. New discoveries and inventions are literally swarming into existence, inevitably threatening to destroy the fabric of the old philosophies. Science is now awaking to the fact that few of her theories of the cosmos are finalities. Instead, therefore, of spending her strength in the defence of old theories, she henceforth must find her proper employment in watching the indications that are leading to new.

The foundation of the physical philosophy of the future is already laid in certain incontrovertible data, and only the practical details yet remain to be wrought out. The following general principles constitute these foundations:

1. The invariability of the quantity of the matter of the universe.
2. The invariability of the quantity of the force of the universe.
3. The conservation of that force.
4. The unity of that force.

We may add to these another fundamental principle, viz., the identity of constitution of all the stellar worlds.

The first four are fully accepted of science. The last, *i. e.*, the universal identity of constitution, is fast becoming generally recognized.

Helmholtz says: "What the earth does is done by the other planets, and in a far higher degree by the sun."

M. Faye says: "Nothing really distinguishes our sun from the multitude of stars which shine in the heavens."

Dr. W. Meyer says: "The sun is composed of the same material as the earth;" "the distant fixed stars are of a composition identical with that of the sun;" "the uniformity of Nature's laws and the similarity of the materials comprising the universe, are a sufficient proof that there must be organizations similar to that of our system all over the universe."

Such identity of constitution appears to be self-evident, and we may well distrust every purely hypothetical explanation of physical phenomena which is inconsistent with this principle.

With regard to the conservation of force, Faraday says: "It is a principle in physics as large and sure as the indestructibility of matter or the invariability of gravity;" "and no hypothesis should be admitted, nor any assertion of fact credited, that denies this principle." With regard to the unity of force, it is sufficient to point to the recent discoveries that have practically demonstrated that all forms of force are resolvable into one another; and that gravity, heat, light, electricity, magnetism, chemical action, vital action, etc., are forms of one essence or force, and not so many independent forces. One universal power transmutable into every conceivable variety of forms is known as a fact.

Upon these few fundamental principles may be erected the structure of an enduring physical philosophy.

Since the earliest ages the scientific world has vaguely conceived of such a power in the movement of the bodies which constitute the starry heavens. Humboldt discerns in Aristotle, the father of Science, the dim recognition of this great fact. In his "Cosmos" he tells us that in the works of that great philosopher he found this idea "constantly recurring, fondly cherished and fostered, but never disclosed with absolute distinctness and certainty." It is this idea that all telluric phenomena, every conceivable form of force, must be ultimately referrable to the impulse of the motions of the celestial spheres. In our opinion, all requirements are met in this, and in no other hypothesis. What the impulse of the motions of the celestial spheres implies it is the province of mathematical science to inform us. The mathematician tells us the power of a cannon-ball, when its size, weight and velocity are known. He calculates with accuracy the amount of work which a revolving wheel is capable of performing when its form, mass and velocity are given. The adequacy of the motions of the earth for the production of all terrestrial force may be gathered from the statement of its mass, its bulk, and its velocity (rotary and progressive). The same process applied to the innumerable host of the celestial bodies, must satisfactorily express the aggregate force of the universe. It is not necessary to know the source of these motions. The fact that they *are* is sufficient. The duty of the hour is to apply the principle in explanation of existing phenomena. The highest office of physical philosophy to-day, therefore, is to show how the motions of the celestial bodies in their stupendous masses and inconceivable velocities are converted into available energy; it is to demonstrate the actual process by which this mighty power performs the world's work, the work of all spheres.

These motions with all their possibilities of force would possess absolutely no efficiency, if those bodies were isolated in vacuous space as they appear to be. Their vast energies arise through some actual and direct intercommunication. The question is, through what agency? An agency fully suited to all requirements is now abundantly demonstrated. This agency is electricity. In late years it has become evident to men of science that there are certain electrical disturbances here which simultaneously involve both the sun and the earth. For example, Flammarion says: "The globe is one vast reservoir of this subtle fluid, *i.e.*, electricity, which exists in all the worlds appertaining to our system, and of which the radiating focus is in the sun itself. Its palpitations sustain the life of the universe." And Secchi says: "It is an incontestible fact that the sun exercises an action upon the magnetic phenomena which are manifested upon our globe." It is these evidences of an electrical relation between the sun and the earth that have furnished positive data whereby the fact of a universal force that is electrical in its character, is not simply an inference, but a necessary and irresistible conclusion. For illustration, the bright sunspots of 1859 seen by different observers produced instantaneous and violent electrical effects over a large portion of the earth. Simultaneously a telegraph operator in Norway was partially stunned, and his apparatus set on fire; a stream of fire followed Bain's electric pen in Boston. In several other places telegraph operators received severe shocks; and self-registering magnetic machines were disturbed over two continents. This phenomenon has been observed more recently by others. This appears to be proof of an electrical communication between the spheres—the sun and the earth—and is accepted by science as a fact, independent of all methods and theories of explanation. So also does science accept as established the connection of sun-spot and auroral phenomena. That the currrent which incessantly comes from the sun to the earth is purely electrical is demonstrated in the action of a lens of ice in an atmosphere at 40° below zero. The sun's rays converged by the ice lens explode gunpowder and set fire to combustible substances.

Certain experiments made with magnets exposed to the rays of the sun remarkably confirm the conclusion that the sun's action is electrical. A record of these experiments, to be found in the columns of *Chambers' Journal* of Aug. 13, 1881, show that magnets both acquire and lose strength according as their poles are relatively exposed to the direct rays of the sun. Professor Barlocci found that a natural armed loadstone, which would carry 1¼ Roman pounds, had its power nearly doubled by six hours' exposure to the strong rays of the sun. M. Zantereschi found that an artificial horseshoe loadstone which carried 13¼ ounces, carried 8¼ more by three days' exposure, and at last arrived at 31 ounces by continuing in the sun's rays. He also tried the experiment of concentrating the solar rays upon the loadstone by means of a lens. He found that magnets acquire strength when the North pole is exposed to the sun's rays and lose strength when the south pole is exposed.

Clearly the only power through which magnets can be increased in force must be electrical or magnetic. The sun could neither add to nor take from the magnetic force of magnets, except its rays were of like character. In these experiments therefore we have incontrovertible demonstration of electrical inter-communication between sun and earth, and, inferentially, between all celestial spheres. These experiments, invaluable to science as rare and exact data, were misinterpreted by their authors when they attributed their results to the effects of the sun's light, instead of to its electrical currents, which alone were capable of such action. The meaning of all this is that there must be and are incessant interactions between the heavenly spheres, and that these inter-actions are electrical—of an electrical origin and governed by electrical laws. If these inferences are correct, the conclusion naturally follows that the universal force is electrical.

What, it may be asked, is electricity, and what has it to do with the celestial motions? What electricity *is* no man knoweth. We behold with astonishment what it *does*. Its rôle in our cosmos is daily becoming more impressive. Indeed, it apparently embodies in itself the philosophy of the future. Generically it includes magnetism. It is now regarded as a single or simple element that acts by contrarieties, so to speak. Its positive and negative manifestations seem opposites, and even more distinct from one another than is electricity from magnetism. But as Grove says, "We cannot electrize a substance without magnetizing it; we cannot magnetize it without electrizing it." Our conclusion from known facts would be that electricity is the agent in its active form, and magnetism the same agent in its more static form.

For a century, electricity has been diligently studied, and its processes carefully observed, until the *modus operandi* of both its development and action has become familiar to all. The time has now come for enlarging the application of its principles. We must recognize the fact that the electrical laws which hold here, hold also throughout the universal domain, and that this study of practical electricity has been a study in miniature of the grand operations of all celestial spheres. The study of processes at hand and of daily observation was a necessary preparation. Our magneto and dynamo-electrical batteries have for us a revelation as well as a practical service. They may be regarded as our typical guides.

It is an accepted principle in electrical philosophy that motion and magnetism develop electricity. In the dynamo-electric battery these elements (motion and magnetism) co operate to develop that wonderful agent, electricity. The machine is formed essentially of magnets and a revolving armature. When the armature is made to revolve near the poles of the magnets, currents of electricity are developed, ready to be conducted by wires leading from the machine. It is to be observed that the armature, though

within the influence of the magnets, doe not come into contact with them. The constitution of what we may call the celestial battery is precisely analogous—the widely separated spheres being the magnets, and their motions the exciting cause of electric currents upon the scale of the cosmos. For example: Our earth is known to be a vast magnet. Its atmosphere is so stored with the magnetic quality as to be equaled only by those most magnetic of all substances, iron, nickel, and cobalt. But this inherent magnetism is purely potential, or static, lacking the active powers of electricity, and without the ability to act or move except as excited by the operation of the celestial motions. Through these motions static magnetism becomes converted into vital active electrical currents. So, by their unceasing rotation, the magnetic sun and earth furnish the needed motions, and supply all conditions necessary to the completion and practical action of the terra-solar dynamo-electrical machine. Thus the static magnetism which is inherent in every star becomes developed into vital active force through the agency of star acting upon star throughout the universe of matter. In the inter-action of this magnetism and these motions is found the *genesis* of the universal force.

These grand inter-stellar currents, generated like those of our diminutive machines, act through positive and negative conditions, and involve a circuit between sun and earth. If, therefore, currents come from the sun, it follows, both by the laws of electricity and the law of conservation of force, that equal currents do return thither from the earth. Granting this, as we are compelled to do, our terrestrial phenomena are at once seen to be electrical problems, whose natural solution is furnished by a practical knowledge of electricity. And since we have learned that many currents are able to pass in each direction at the same instant over the same telegraph wire, it is to be inferred that a multiplicity of solar currents may pass to and fro without interference. Professor Edland, of the Royal Society of Stockholm, Sweden, who has been experimenting for years, affirms that a perfect vacuum is favorable to the conduction of electricity. This fact has been demonstrated more recently by Edison. Thus the vast vacuous space is most favorable for the transmission of inter-stellar currents.

GRAVITY: ITS ESSENTIAL NATURE.

In the commonest phenomena the operation of the universal force may be studied. This electrical theory of force, when applied in explanation of sun phenomena, gives to each a most simple and natural interpretation. The fundamental electrical character of that mysterious power, gravity, is revealed. It is known that bodies susceptible to electrical excitation become centers of attraction through the operation of the electrical current. A body of soft iron is thereby made magnetic, and retains its power of attraction during its continuance in the circuit. Sun and earth are vast magnets excited into activity by their motions, and thus made constituents in a grand magnetic circuit, and both they and all things they contain become thoroughly vitalized with the energy which we call gravitation; hence gravity.

We are well aware that the present scientific authorities uniformly represent gravity as resident in particles and masses of matter, but we are also aware that that prince of philosophers, Faraday, gave testimony to not only his own, but also to Newton's dissatisfaction with that view. He said: "For my own part, many considerations urge my mind toward the idea of a cause of gravity which is not resident in the particles of matter merely, but constantly in them and in all space." Newton, in writing to a friend, desired that he would not attribute innate gravity to him. "Gravity," said he, "must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, I have left to the consideration of my reader." The concluding page of the mathematical portion of the "Principia" hints at that agent which today would seem to be the demonstrated agent of gravity. His words are these: "Hitherto we have explained the phenomena of the heavens and of our sea by the power of gravity, but have not yet assigned the cause of this power. It is certain that it must proceed from a cause that penetrates to the very center of the sun and planets without suffering the least diminution of its force." Newton ends this, his masterpiece, with the following significant words concerning electricity: "And now we might add something concerning a most subtle spirit which pervades and lies hid in all gross bodies, by the force and action of which spirit the particles of bodies mutually attract each other at near distances and cohere if contiguous, and electric bodies operate to greater distances, as well repelling as attracting the neighboring corpuscles; and light is emitted, refracted, reflected, inflected and heats bodies; and all sensation is excited, and the members of animal bodies move at the command of the will, namely, by the vibrations of this spirit mutually propagated along the solid filaments of the nerves, from the outward organs of sense to the brain, and from the brain into the muscles. But," he continues, "these are things that cannot be explained in a few words, nor are we furnished with that sufficiency of experiments which is required to an accurate determination and demonstration of the laws by which this electric and elastic spirit operates." Thus almost prophetically speaks Newton.

Nothing is clearer or more profoundly significant than the fact that Newton, instead of making gravity itself fundamental, sought earnestly for a cause of gravity. We are simply walking in his footsteps when we do the same, and when we find in the more perfect data of to-day ample proof that electricity is, in fact, what Newton himself and Faraday obscurely suspected—the very agent sought for. It is thus found that the relation between electricity and gravity is simply that of *cause* and *effect*. The vital bearing and importance of this philosophy reach out into other fields as well. There is scarcely a limit to the subjects which would be illuminated by a full recognition of this fact.

The electrical theory brings gravity into full correlation with the other so-called great physical forces—a consummation long and hopefully, yet unsuccessfully sought for by the great Faraday, who first demonstrated the mutual transmutability of all, save gravity.

Electric Lighting in Pittsburgh.

Editors of the Electrical Review:

The only electric lighting company in this city is the Allegheny County Light Company. They have been in operation for four years, and have now some 250 Brush arc lamps in operation. They are doing a good profitable business, and on July 1st declared a semi-annual dividend of 3½ per cent. They use the Brush system, and it seems to give good satisfaction.

The works are on Virgin Alley. The engines are located on the first floor, the dynamos on the second floor, and the power is supplied by four boilers of 100 horse-power each. The fuel used is natural gas.

The engines and dynamos are in good order and well arranged for their work.

The office of the company, which should, I think, be in a more prominent location, is on the second floor. Gas companies are noted for their convenient and pleasant offices; but electric light companies, I have found in my travels, seem to go to the opposite extreme. A corporation engaged in the "lighting" business should have pleasant business offices and your correspondent hopes to see this improvement made in the future, particularly by those companies whose dividends would indicate that it could be afforded.

Pittsburgh, Aug. 31. M. P.

—— The Bain Electric Company, of Chicago, have located at the north-east corner of Franklin and Illinois streets. The machinery is being set and the company start out with several orders for arc and incandescent lights. They are at present employing between 75 and 80 men.

—— Jose F. de Navarro, Robert Bliss, Narcisco Villaverde, John J. M. Cook and James Clyne are the corporators of the Buell Electric and Pneumatic Company which has filed certificate of incorporation in the office of the County Clerk. Its objects are to purchase, lease and acquire patents for mechanical and other inventions and appliances to be issued or granted by any government, and especially for patents appertaining to inventions and improvements for electrical and pneumatic purposes, and for the use and application of electricity or compressed air, or both, as a means of heating, refrigeration, propulsion, locomotion or transportation and the transfer, movement, distribution and regulation of heat, cold, light, force or power, by means of mechanical and other appliances, and the manufacture of such machinery. The capital stock of the company is $10,000, divided into 1,000 shares of $10 each.

—— Experiments have been made by the authorities of the German army to determine the illuminating power of the electric light on distant bodies. In these experiments the distance of the source of light or arc lamp, from the illuminated object, and the distance of the observer from the same, were both taken into account; that is to say, the total distance traveled by the rays from the lamp to the object, and thence (by reflection) to the eye of the spectator. It was found that with a distance of the object from the lamp of 8,000 meters the observer could see it at 50 meters distance; with a distance of the object from the lamp of 6,000 meters the observer could see it at 600 meters, and when the former distance was only 1,500 meters, the object was visible at a distance of 4,300 meters. Other experiments made with a stronger lamp gave similar results, the greatest distance traversed by the rays being 10,500 meters, 4,500 of which measured the path of the reflected light, and the remaining 6,000 the path of the direct rays between the lamp and the object illuminated.

—— The Australian Electric Light Company, says a contemporary, were engaged during the recess of the Australian House of Parliament in introducing the electric light into both the Assembly and Council chambers and their approaches. The work, which was carried out under the personal direction of the company's manager (Mr. Josepbs) was practically finished early in June; and according to the latest advices received, it was to be publicly tested for the first time on the reassembling of the House on the 16th of that month. The present scheme is not intended for all parts of the building, as in the reporters' rooms, domestic quarters, &c., the use of gas will be continued. In accordance with the wishes of the Parliamentary Buildings Commission the company submitted two tenders. The first provided for five groups, which comprised the number of arc lights required for the exterior of the building; and the contract price, including the extension of the installation to all parts of the building, was about £7,000. The second tender contracted for fittings for only four groups of the building; but it was stipulated that the motive power to be supplied under the contract should be sufficient for five groups. The price named in this contract was about £5,600; and the tender was accepted on the understanding that the company should, if required, extend the installations to the fifth group at the price stated in the first contract. There are two 20 horse-power engines which drive two dynamo machines, each capable of supplying 275 lamps, or a total of 550 for the two. This, it is thought, will sufficiently light the whole of the building. But as a necessary precaution a third dynamo has been provided in the event of any mishap occurring to the two already mentioned; thus dispelling any fear of sudden stoppage in the supply of the light. The company have endeavored to provide against any sudden emergency that may arise, the gas fittings being still retained in both chambers and in the library; but unless both engines should break down it is presumed there will not be occasion to resort to the use of gas for lighting purposes.

—— The Riverside penitentiary, Allegheny City, Pa., will put in 1,500 incandescent and 35 arc lights at an early day. The system is Thomson-Houston.

—— The Ashington Coal Company are about to have the electric light adapted to the requirements of their extensive colliery near Newbiggin, Northumberland.

—— Buffalo has an electrical society that is well attended; a number of interesting and instructive lectures on electricity having been delivered by Prof. A. L. Arey.

—— The crossing of the circuit of the electric light company at Newburgh, Mass., left the city without its electric light one evening last week. The cause of the cross is a mystery.

—— The city of Santiago, Cal, is arranging to have an electric-light plant put in, and will use four masts, carrying four arc lamps each. There is quite an encouraging demand for private lighting by the business men of the city.

—— Work on the electric light buildings at Troy, N. Y., is being pushed rapidly, and it is thought all departments will be finished by October. The machinery in the west wing is now being put in order for use, and, as soon as the boiler and other works are taken from the old part of the building on Washington street, it will be torn down and a new addition built. The smoke-stack for the works, which is being built, will be the highest in the city—132 feet.

—— Richard Aherns, aged 18 years, in company with Mike Rees and Joseph and William Sefton were carelessly handling an electric wire of the Louisiana Electric Light Company, on Feliciana street, New Orleans, between St. Claude and Marais streets, when the current was turned on and the shock instantly killed Aherns. None of the others were hurt. For some time past Aherns and his friends have been in the habit of taking the wire from around a broom, tieing a stone at the end of it, throwing it over the electric wire, and making it fast to a gate knob. When the current was turned on, the boys would take hold of the small wire and feel a tingling sensation. Last evening Aherns became bolder than the rest of the boys and put his tongue to the wire. The shock went through and prostrated him, and his brother exclaimed: "My God, he is killed." At these words Aherns got up and said: "No, I am not yet dead." He had hardly spoken these words when he fell back the second time a corpse.

—— A new forty-horse engine has been started in the basement of the Connecticut Mutual Life Building, Hartford, Conn., attached to a one-hundred-light dynamo machine, introduced by the Schuyler Electric Light Company of that city. The Connecticut Mutual Company have put in this plant to furnish electric lights for their vaults, in substitution for gas, which has heretofore been used, the effect of the combustion in the close vaults having been found to be destructive of the binding of their books and records. The number of lights thus used is thirty-eight, the remaining sixty-two of the one-hundred-light plant being reserved for the possible wants of the various tenants of the company's building. At the start the new engine and new electric machinery proceeded to business with the regularity and thoroughness of old stagers without the least effort or friction; and the mellow incandescent lights leaped from the carbons as naturally and softly as if they had been doing the same thing ever since the creation. This little plant of the Connecticut Mutual Life Company is a fair illustration of the manner in which the Schuyler Company does its work, and what its incandescent light is in fact as well as in theory.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING AUG 25, 1885.

324,799 Telegraphy; William E. Athearn, New York, N. Y.

324,808 Automatic specific gravity apparatus; Gabriel A. Bobrick, Boston, assignor by mesne assignments to himself and Frederick N. Wales, Newton, Mass.

324,824 Electric clock; Frank R. Field, Greenfield, Mass.

324,858 Galvanic battery; Jesse B. Low, Watertown, N. Y.

324,862 Regulator for dynamo-electric machines and motors, Richard H. Mather, Windsor, Conn.

324,891 Electro-dynamic motor; Frank J. Sprague, New York, N. Y., assignor to the Sprague Electric Railway and Motor Co.

324,892 Electric railway motor; Frank J. Sprague, New York, N. Y.

324,894 Socket for incandescent electric lamps; Wm. Stanley, Jr., Englewood, N. J

324,899 Electric railway; Charles J. Van Depoele, Chicago, Ill.

324,957 Telegraph insulator; Jacob D. Putnam, South Lyndeborough, N. H.

324,978 Arc lamp; Alexander H. Bowman, Packerton, Pa.

324,979 Alternating switch for incandescent lamps; Jno. A. Cabot, New York, N.Y., assignor to the Cabot Electric Light and Manufacturing Company, of New York.

324,980 Safety device for incandescent lamps; John A. Cabot, New York, N. Y., assignor to the Cobot Electric Light and Manufacturing Co., of New York.

325,011 Current meter; Wm. G. Price, New Orleans, La.

325,086 Electric belt; Lee Hughes, Marshall, Mo

325,113 Electric impulsion device for a torsion pendulum; Heinrich Rabe, Hanan, Prussia, Germany.

325,120 Secondary battery or electrical accumulator; John S. Sellon, Hatton Garden, London, County of Middlesex, England.

325,124 Circuit closer; Adolph T. Smith, New York, N. Y.

325,133 Regulator for dynamo-electric machines; C. J. Van Depoele, Chicago, Ill.

325,225 Electric current meter; Charles J. Van Depoele, Chicago, Ill.

BUSINESS NOTICE.

Wanted —We are in need of a practical man, who has enough experience in electric lighting to take charge of a plant, and get the best results from the same. We are operating the Sperry arc, and the Weston arc, and large and small incandescent lamps. What we want is a working electrician; one who can handle his men, as well as jump right in himself. Replies should be sent to Box 304, Omaha, Neb.

UNION SQUARE HOTEL,
AND HOTEL DAM,
HEADQUARTERS:
Telephone, Telegraph and Electric Light People.
A. J. DAM & SON, Proprietors,
Union Square, cor. 15th Street, New York.

CONNOLLY BROS.,
Patent Attorneys
AND SOLICITORS,
Pittsburgh, Pa.;
PHILADELPHIA, PA.,
Mutual Life Ins. Building, 10th and Chestnut Sts.;
WASHINGTON, D. C.,
CORNER 6th AND F STREETS.
Electrical Cases a Specialty.

WHEN WRITING for Catalogues & ordering Articles advertised in our columns please mention that you saw the advertisment in the ELECTRICAL REVIEW.

SUNLIGHT CARBONS!
MANUFACTURED BY THE
PARKER-RUSSELL
Mining and Manufacturing Com'y,
711 Pine Street, - - - - - - - - - St. Louis, Mo.
100,000 CARBONS PER WEEK.
Using the purest materials and with machinery of our own invention,
Every Carbon is manipulated separately from the beginning of the operation until finished.
They are, therefore,
ABSOLUTELY UNIFORM AND EACH CARBON ALIKE IN ALL ITS PARTS.
In straightness, length of time in burning, brilliancy and steadiness of light they excel all others, and are adapted to the various systems of lighting in use.

— EDISON —
ELECTRIC LAMPS

⅛ TO 16 CANDLE-POWER.
SURGICAL AND DENTAL LAMPS, PRIMARY BATTERIES, STORAGE BATTERIES, LARGE AND SMALL MOTORS, and all ELECTRIC LIGHT GOODS.
The Stout, Meadowcroft Co.,
Authorized Agents for the
EDISON LAMP CO.,
21 & 23 ANN ST.,
P.O. Box 2411. New York.
SEND FOR CATALOGUE.

MODEL and EXPERIMENTAL WORK A SPECIALTY.
Send for Circulars.
C. E. Jones & Bro.
CINCINNATI, O.
(Mention this Paper.)

Bureau of Audit,
No. 23 Park Row,
Room 7. New York.
Corporation and Mercantile Books
EXAMINED & AUDITED.
Telephone Accounts a Specialty.
P. O. Box 3329.
CHARLES DUTTON, President. E. S. HATHAWAY, Secretary.
Refer to ELECTRICAL REVIEW.

OKONITE
CHARLES A. CHEEVER, President. WILLARD L. CANDEE, Treasurer.
THE OKONITE COMPANY,
Formerly New York Insulated Wire and Vulcanite Co.,
MANUFACTURERS OF
INSULATED WIRES AND CABLES,
No. 13 PARK ROW, NEW YORK.

The Bergmann 'Telephone' Battery.

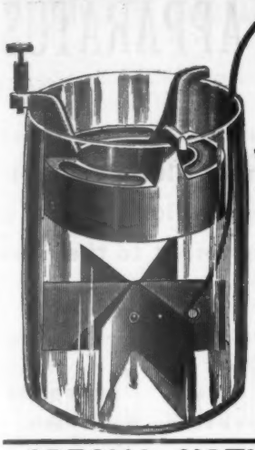
THE BEST
Open-Circuit Battery
IN THE MARKET.
Superior to the Leclanché & all others for Telephone Work, Annunciators, Burglar Alarms, Gas Lighting, etc., etc., in short for all kinds of open circuit work.
PRICE, (complete) $1.00.
Liberal Discount to dealers and large consumers.
Send for Circular and Price List.
BERGMANN & COMPANY,
Electrical Works,
292, 294, 296, 298 Ave. B, New York, N. Y.

Subscribe
FOR THE
ELECTRICAL REVIEW.
If you care for COMPLETE and RELIABLE electrical information, the Illustrated ELECTRICAL REVIEW, 23 Park Row, New York City, is THE PAPER FOR YOU.
Price, $3.00 per year.
Particular attention paid to the wonderful advance in Electric Lighting.

THE GENUINE LECLANCHÉ DISQUE CELL, COMPLETE.

DO NOT buy any POROUS CUP BATTERY unless it bears the trade-mark "GONDA" and the LABEL as shown in cut.
Only those so marked and labeled are the
Genuine Leclanché Disque Cell.
The United States Courts have decided this Label to be exclusively ours, and no one else can use it. It marks every Battery made by us, and all without it are imitations.
The GENUINE LECLANCHÉ DISQUE CELL is made ONLY by us. Do not let dealers impose IMITATIONS upon you.
If they have not the GENUINE send to us direct for it. It is far superior to others, and as low in price as any that are worth having at all. Send for circular and price list.
THE LECLANCHÉ BATTERY CO., 149 W. 18th St., N. Y

Standard Electrical Works,
MANUFACTURERS OF
TELEGRAPH AND TELEPHONE APPARATUS,
Hotel and House Annunciators, Burglar Alarms,
CALL BELLS, "POST'S" MAGNETO BELLS,
PINS and BRACKETS, BATTERIES, &c., &c.
IN STOCK—FULL LINE
IRON, STEEL and HARD-DRAWN COPPER WIRE, Delivered at Lowest Prices.
ESTIMATES FURNISHED. SEND FOR CATALOGUES AND PRICES.
Cincinnati, Ohio, U. S. A.



THE MORRISON

Gravity Battery

THE ONLY RELIABLE CLOSED-CIRCUIT BATTERY IN EXISTENCE.

After thirty years' experimenting with other batteries, The Gamewell Fire Alarm Telegraph Co. adopted it as their standard.

OFFICE OF THE GAMEWELL FIRE ALARM TELEGRAPH CO.,
1½ BARCLAY ST., NEW YORK CITY.
NEW YORK, August 14th, 1885.

THE SOUTHERN ELECTRIC CO., BALTIMORE, MD.

Gentlemen:—We have adopted the "MORRISON GRAVITY BATTERY" as the Standard Fire Alarm Battery for this company's service. After thirty years' experience we unhesitatingly endorse it as the best form of Gravity Battery ever devised.

Yours very truly, J. N. GAMEWELL,
General Superintendent Gamewell Police & Fire Alarm Telegraph Co.

Manufactured only by

THE SOUTHERN ELECTRIC CO.,

Warerooms, Hoen Building, cor. North and Lexington Sts.;
Works, cor. Constitution and Monument Sts.,

BALTIMORE, MD.

SPECIAL NOTICE.

NATIONAL TELEPHONE EXCHANGE ASSO'N.,
SECRETARY'S OFFICE, 397 FULTON ST.,
BROOKLYN, N. Y., July 20, 1885.

NOTICE.—The annual meeting of the Association will be held Tuesday, September 8, at 10:30 A. M., Narragansett House, Providence, R I. Committee of Arrangements—Gov. Henry Howard, Gen. C. H. Barney, Eugene Phillips, J. W. Duxbury, and A. C. White. The proceedings will embrace "The Report of the Committee on a Standard Wire Gauge," and papers on the following subjects: "Legislation." by H. L. Storke; "Exchange Statistics," by B. E. Sunny; "Some Practical Results of Long-Distance Telephoning," by A. S Hibbard; "Observations on the Use of Cables in Cities," by C. N. Fay; "On the Law Multiple Switchboard," by Dr. S. M. Plush; "The Underground Problem," by the Western Electric Co.; "Theory and Practice of the Construction of Telephone Cables," by Dr. W. W. Jaques; "Telephones, Transmitters and Magneto Bells," by E. T. Gilliland.

Statements and descriptions will also be given of the details and progess of the underground work in Washington, Brooklyn, New York and Pittsburgh. WM. D. SARGENT, Secretary.

PAINE & LADD,

HALBERT E. PAINE, Late Commissioner of Patents. | STORY B. LADD.

Attorneys in Patent Causes And Solicitors of Patents.

WASHINGTON, D. C.

THE NATIONAL

Time Regulating Co.,

BOSTON, MASS.

Is now prepared to contract with

TELEPHONE COMPANIES

In the United States for the use of its Instruments for sending

Accurate Time Signals by Telephone

Every minute of the day or night.

By ONE INSTRUMENT in an exchange any number of subscribers in that exchange can be furnished with **Accurate Time** at a *nominal price* per year.

No change in subscribers' instruments required. Does not interfere with conversation. The subscriber simply listens at the receiver, without calling, and the signals are plainly audible.

For full particulars, please address,

JOHN M. ORAM,
GENERAL MANAGER,
P. O. Box 1351, BOSTON, MASS.

Disque Leclanché Battery

A SAVING OF TWO-THIRDS OF THE COST OF TRANSMITTER BATTERIES.

The particular attention of telephone companies is called to the great economy involved in the use of **"DISQUE"** over any other form of **Leclanche Battery;** its present low cost being such that, in quantity, the *Complete* Disque Cell is furnished for the price of a single pair of prisms, while instead of requiring renewal once every four to six months, the Disque Porous Cup does first class transmitter and bell work for from 18 to 30 months.

The renewal of the porous cup costs but little more than half the price for prisms.

A number of the largest telephone companies in the United States have already availed themselves of this plain advantage, and are using our Disque Battery exclusively.

As to the many other forms of Sal Ammoniac-Carbon-Zinc, "Open Circuit," and "Telephone Batteries," it is quite apparent that their only advantage existed while high prices were charged for Disque Leclanché Battery. Now that the Disque, which is the *foundation* Sal Ammoniac Battery, and the best of any or all, has also become the cheapest, there can be no question as to the entire economy of its use above all others.

PRICES

BATTERY, COMPLETE,	$1.00	ZINC, WITH CONNECTOR,	$ .10
POROUS CUP, - - .	.75	SAL AMMONIAC, - -	.08
GLASS JAR, - -	.18	COMPLETE CELL, SEALED,	1.20

LARGE DISCOUNTS TO TELEPHONE EXCHANGES AND THE TRADE.

All Disque Leclanche Batteries furnished by us are warranted to be in every particular the same original and genuine article which has during the past ten years become thoroughly well known as the best of all Open Circuit Batteries.

J. H. BUNNELL & CO.,

Nos. 106 & 108 LIBERTY STREET, NEW YORK.

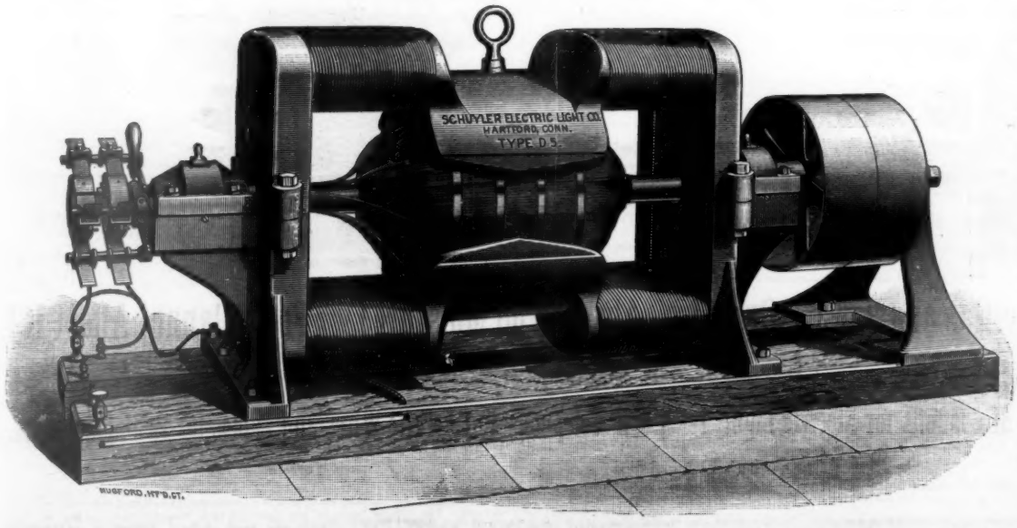
SEND FOR OUR LATEST LARGE ILLUSTRATED CATALOGUE, NO. 7, OF JULY, 1885.

SCHUYLER ELECTRIC LIGHT CO.,

MANUFACTURERS OF

DYNAMO MACHINES AND LAMPS

FOR INCANDESCENT AND ARC LIGHTING.



The most perfect system of Arc and Incandescent lighting.

Entire freedom from hissing and flickering in our Arc Lights, and long life and great brilliancy in our Incandescent Lights.

Dynamo Machines with perfect automatic regulation, reliable and efficient.

Prices moderate.

Estimates made for lighting from Central Stations or for isolated plants.

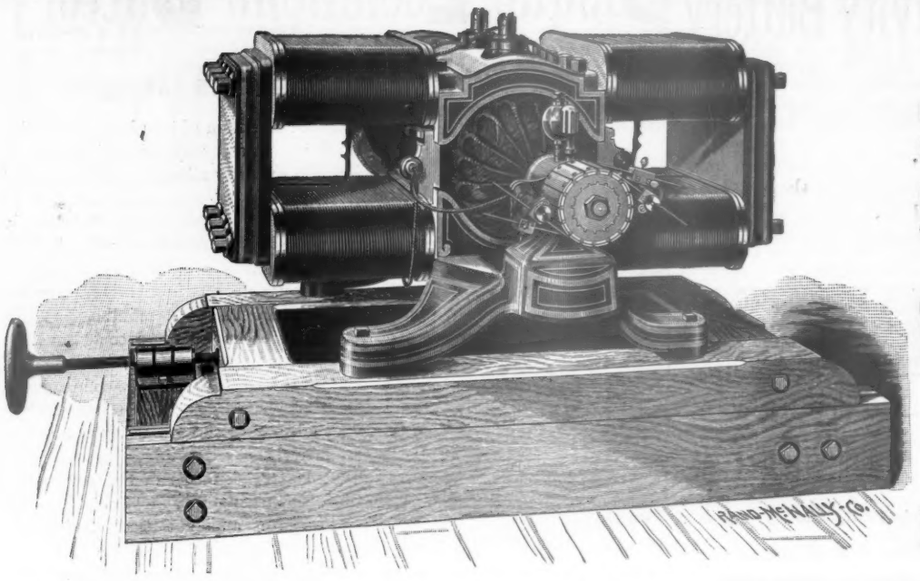
Illustrated circulars sent upon application.

ADDRESS,

SCHUYLER ELECTRIC LIGHT COMPANY, HARTFORD, CONN.

NEW YORK OFFICE, - - - 44 BROADWAY.

WESTERN ELECTRIC COMPANY'S ELECTRIC LIGHTING APPARATUS



Every requisite for the most perfect system of Electric Lighting, at prices which insure a profitable investment to the purchaser.

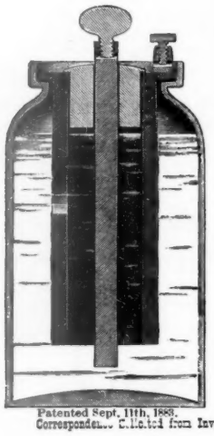
ADDRESS,

Western Electric Company,

CHICAGO OR NEW YORK,

MANUFACTURERS OF AND DEALERS IN ALL KINDS OF

Electrical Apparatus and Supplies.



Patented Sept. 11th, 1883.
Correspondence Solicited from Inventors or others desiring to Patent or Introduce Electrical Novelties of Merit,

"Little Giant" Battery.

UNEQUALED FOR

GAS LIGHTING, BURGLAR ALARM, TELEPHONE, ELECTRIC BELL, ANNUNCIATOR AND CLOCK WORK,

Or any Service to which an Open-Circuit Battery can be Applied.

Cannot be destroyed by short circuit. Carbons practically indestructible, as they can be renewed by simply washing in pure water. Great saving in number of cells required as compared with any Open-Circuit Battery now in use. Can be sealed if desired. *Try it and be convinced.*

PRICE, $1.25 PER CELL.

LIBERAL DISCOUNT TO DEALERS AND LARGE CONSUMERS.

RHODE ISLAND TELEPHONE AND ELECTRIC CO.

PROVIDENCE, R. I.

P. O. BOX, 1127.

THE GRAND RAPIDS

Electric Light and Power Com'y,

Sole Manufacturers of the

THOMAS ELECTRIC LIGHTING APPARATUS.

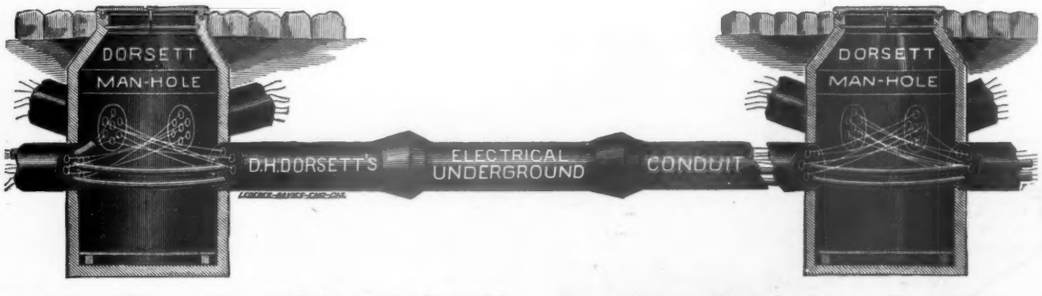
Fully Protected by Patents.

The THOMAS ARC LAMP is the Simplest, Surest and Most Effective Arc Lamp now extant. It possesses all the advantages of the best Lamps in use, and is less complicated than any. It cuts OUT AND IN automatically. Adapted and made to fit the current of any style of generator.

The THOMAS INCANDESCENT SYSTEM, by means of which incandescent lamps can be operated on the same circuit with arc lamps economically and with perfect safety. This system has been in successful operation for nearly two years at Grand Rapids, Mich., and is now being extensively introduced throughout the country.

For particulars in regard to any of the above apparatus, address the above company at **GRAND RAPIDS, MICH.**

DORSETT'S UNDERGROUND CONDUIT SYSTEM.



Electrical Insulator, Water, Gas and Sewage Proof! Absorbs no Moisture! Frost Cannot Affect It!

CRUSHING STRAIN, 5,500 LBS. PER SQUARE INCH—GOVERNMENT TEST.

A Complete, Comprehensive System of Conduits for Electric Light, Telegraph, Telephone and Private Wires and Cables for Rental Purposes.

The 2¼-inch ducts in this Conduit are leased to different companies, which may then occupy them with such wires and cables as they may adopt. New wires may be introduced or old one replaced through these ducts between the man-holes as shown in the cut.

An experience of six years for Underground Drainage has shown the superiority of this material as a resistant of moisture, and its consequent immunity from damage by frost. It has been in use for electrical purposes the past winter in the solidly frozen streets of Chicago without injury; is the system used by that city, giving perfect, unbounded satisfaction, and is now being introduced into the cities of St. Louis, Cincinnati and Detroit. The whole body of the Conduit is a thoroughly reliable insulator, unaffected alike by acids and alkalies. The cheapest and most perfect Conduit in the market to-day.

☞ **CORRESPONDENCE SOLICITED.** ☜

D. H. DORSETT, Proprietor, No. 61 {La Salle Street, Chicago, Ill.

ROYCE & MAREAN,
DEALERS IN
ELECTRICAL APPARATUS,
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel, **WASHINGTON, D. C.**

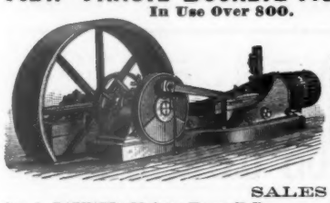
H. M. RAYNOR,
No. 25 BOND ST., NEW YORK.
Established 1859.
PLATINUM IN All Forms FOR ALL PURPOSES,
WHOLESALE AND RETAIL.

Electric Light.
HENRY C. REES,
730 Sansom St., Philadelphia, Pa.,
Undertakes the Furnishing and Erection of
Electric Light Plants of every system.
Incandescent Wiring and Repairs to Dynamos and Lamps a specialty.
Estimates furnished on application.

JARVIS ENGINEERING CO.,
BOSTON, MASS.,
Contractors for
COMPLETE STEAM OUTFITS for Electric Lighting Stations,
Steel Boilers with Jarvis Furnaces to burn cheap fuels,
ARMINGTON & SIMS' ENGINES, ETC.
SEND FOR CIRCULARS.

REMINGTON
Standard Type-Writer.
Ask for Particulars Regarding the Use of the Remington Type-Writer in Receiving Messages.
WYCKOFF, SEAMANS & BENEDICT, 339 Broadway, New York.

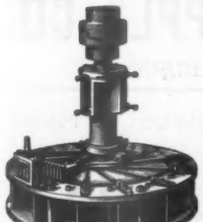
NEW TANGYE BUCKEYE AUTOMATIC CUT-OFF ENGINES.
In Use Over 800.
25 to 1,000 H. P.



These Engines are the combined result of long experience with automatic cut-off regulation and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and superior regulation guaranteed. Self-Contained Automatic Cut-off Engines, 12 to 100 H.P. for driving Dynamo Machines a SPECIALTY.—Illustrated Circulars with various data as to practical Steam Engine Construction and performance, free by mail. Address
BUCKEYE ENGINE CO., Salem, O.

SALES AGENTS:
Geo. A. BARNARD, 70 Astor House, N. Y., and 53 Mason Building, Boston, Mass.
D. L. DAVIS, 34 S. Canal St., Chicago, Ill.
and ROBINSON & CAREY, St. Paul, Minn.

James Leffel's IMPROVED **WATER WHEEL.**



Made by JAMES LEFFEL & CO.

The "OLD RELIABLE" with Improvements, making it the **Most Perfect Turbine now in use,** comprising the **Largest** and the **Smallest** Wheels under both the **Highest** and **Lowest** Heads in this country. Specially adapted for running Electric Dynamos on account of the great steadiness of its motion. Our new Pocket Wheel Book sent free. Address
JAMES LEFFEL & CO.,
Springfield, Ohio, - AND - 110 Liberty St., New York.
[Please mention this paper when your write to us.]

Poole & Hunt's Leffel Turbine Water Wheel.
Made of Best Materials and in the Best Style of Workmanship.
MACHINE-MOLDED MILL GEARING,
From 1 to 20 feet diameter, of any desired face or pitch, molded by our own special machinery.
SHAFTING, PULLEYS AND HANGERS
Of the latest and most improved designs.
Transmission Machinery
A SPECIALTY.

☞ Special attention given to Heavy Gearing. Shipping facilities the best in all directions.
POOLE & HUNT, Baltimore, Md.

THE AMERICAN BELL TELEPHONE CO.
95 MILK STREET, BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The transmission of Speech by all known forms of Electric Speaking Telephones infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof, and liable to suit therefor.

Incandescent Lamps,
From 8 to 150 C. P. (Battery Lamps from 1-2 to 8 C. P.) made in large quantities at short notice.
ADDRESS,
SUN ELECTRIC LIGHT CO.,
WOBURN, MASS.

Automatic Cut off ENGINES
Embodying a New System of Regulation. The Governor Weighs the Load
The most perfect Governing ever obtained. Send for Circular F.

BALL ENGINE CO. ERIE, PA. WE GUARANTEE better regulation than it is possible for any other ENGINE to give.

SHEPARD'S $60. CELEBRATED
SCREW CUTTING FOOT LATHE.

Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, &c. Send for catalogue of outfits for amateurs or artisans. Address,
H. L. SHEPARD, Agt.,
134 E. SECOND STREET, CINCINNATI, O.

"OTTO" GAS ENGINE
OVER 10,000 IN USE.
Started Instantly by a Match.
When Stopped all Expense Ceases.

Works without boiler, steam, coal, ashes or attendance. Successfully adapted instead of steam power in all industries and offers special advantages for running electrical machinery for Telegraph and Telephone as well as Lighting purposes.
Built in Sizes of 1, 2, 4, 7, 10, 15 & 25 ind. H. P.
SCHLEICHER, SCHUMM & CO.
N. E. cor. 33d & Walnut, Phila.
Branch Office: 214 Randolph Street, Chicago.

WORK SHOPS
WITHOUT STEAM POWER
BY USING OUTFITS OF
Barnes' Pat. Foot-Power

machinery can compete with steam power. Sold on trial. Metal and wood workers send for prices. Illustrated catalogue free.
W. F. & JNO. BARNES CO.,
Address No. 1995 Main St. Rockford, Ill.

Telegraph and Electrical SUPPLIES
Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue C. E. JONES & BRO. Cincinnati, O.
It is important to us that you mention this paper.

HARRIS-CORLISS STEAM ENGINE
BUILT BY
WILLIAM A. HARRIS,
PROVIDENCE, R. I.

From 10 to 2000 Horse Power, with Harris's Improvements. These Engines are of
UNEXCELLED WORKMANSHIP,
and are known the world over as the
MOST ECONOMICAL STEAM ENGINE BUILT.
ELECTRIC LIGHT COMPANIES TAKE NOTICE! They are especially adapted for all purposes where continuous service at uniform speed is required and at the minimum of cost of repairs.
Send for a copy of Engineers' and Steam Users' Manual by J. W. Hill, M. E. Price, $1.25.

CHICAGO, **RAILWAY TELEGRAPH SUPPLY CO.** ILLINOIS.
Manufacturers of
Telegraph Instruments & Supplies.
Our Shop is now Fully equipped for Turning Out all kinds of
ELECTRICAL SUPPLIES, and in any Quantities. Special or Experimental Work promptly done. We can furnish FROM OUR STOCK
Telegraph and Telephone Wires, Telegraph Instruments and Supplies, Electric Light Supplies, Battery Materials and Batteries Complete, Electric Gas Lighting Apparatus, Electric Bells, Telephone Supplies, &c.
TWO OF OUR LEADING SPECIALTIES ARE MAGNETO BELLS AND ANNUNCIATORS.
ADDRESS:
RAILWAY TELEGRAPH SUPPLY CO.,
UNION and FULTON STS., CHICAGO.
PLEASE MENTION THIS PAPER.

Electric Light Globes,
Manufactured by
NEW ENGLAND GLASS WORKS, BOSTON, MASS.
Send for Price List.

THE THOMSON-HOUSTON ELECTRIC CO.
Principal Office, 131 Devonshire St., Boston, Mass.,
FURNISHES THE
ONLY PERFECT AUTOMATIC, SELF-REGULATING SYSTEM OF ELECTRIC ARC-LIGHTING IN THE WORLD.
In all desirable qualities of ELECTRIC ARC LIGHTS the THOMSON-HOUSTON SYSTEM has no equal. The Lights are *superior in color and steadiness,* and the entire apparatus is more *economical, efficient* and *safe,* more *easily managed,* and *less liable to derangement* than any other.
THE THOMSON-HOUSTON ELECTRIC CO. was awarded the FIRST PRIZE for the *best system* of arc lighting, and the *best Arc Lamp,* at the Cincinnati Industrial Exposition of 1883.
The Thomson-Houston System has been awarded *superiority in all the competitive tests* to which it has been subjected. NEW ILLUSTRATED PAMPHLET will be sent on application.

TRIPLEX INSULATED

Wire and Rubber Co.

Superior Quality of Insulation

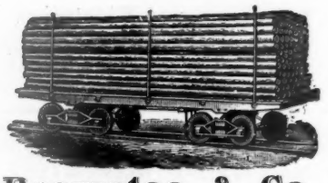
ON ALL CLASSES OF

Electric Wires

—AND—

CABLES.

Address, 159 FRONT ST., New York City.



Brownlee & Co.,

DETROIT, MICH.

DEALERS IN

Cedar Telegraph Poles

MANUFACTURERS OF

Cross Arms, Pins and Brackets,

OAK AND LOCUST PINS,

BROWNLEE'S CONCAVED BRACKET.

(Patent applied for.) Send for Catalogue.

American Electrical Works

MANUFACTURERS OF

Patent Finished Insulated

Electric Wires,

TELEPHONE AND ELECTRIC CORDAGE,

ELECTRIC LIGHT WIRE

MAGNET WIRE.

PATENT RUBBER COVERED WIRE, OFFICE AND ANNUNCIATOR WIRE, LEAD-ENCASED WIRE ANTI-INDUCTION AERIAL AND UNDERGROUND CABLES ETC., ETC.

OFFICE AND FACTORY:

No. 67 STEWART STREET,

PROVIDENCE, R. I.

EUGENE F. PHILLIPS, President.

W. H. SAWYER, Secretary and Electrician.

WHITE

Oak Pins and Brackets

OF OUR OWN MANUFACTURE.

TELEPHONE SWITCHBOARDS,

ELECTRIC BELLS,

MEDICAL BATTERIES,

AND A FULL SUPPLY OF

Covered Wires and Electric Sundries

ALWAYS ON HAND.

Send for Catalogue.

DETROIT ELECTRICAL WORKS,

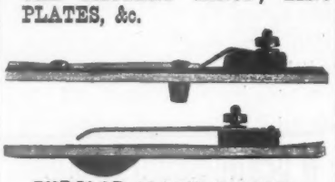
Cor. 7th and Woodbridge Streets,

DETROIT, MICH.

ZINCS

LECLANCHE ZINCS, with thumb screw or patent spring connections, from pure spelter, and well amalgamated.

BUNSEN BATTERY ZINCS; MEDICAL BATTERY ZINCS; ZINC PLATES, &c.



BURGLAR ALARM SPRINGS,

A new and reliable spring, with rubbing contacts, open or closed circuits.

Electric Bells of every description. Batteries & Supplies.

The Conn. District Telegraph & Electric Co.,

82 Bank St. - - - - - - - Waterbury, Conn.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue **C. E. JONES & BRO. Cincinnati, O.**

It is important to us that you mention this paper.

PHOSPHOR-BRONZE

TELEPHONE WIRE,

Insulated and Bare.

"Phosphor-Bronze."

Combines High Electrical Conductivity and Resistance to Corrosion with Lightness and Tenacity.

Standard Sizes, 16, 17, and 18, Stubs' Gauge.

ADDRESS:

The Phosphor-Bronze Smelting Co. (Limited,)

512 ARCH ST., PHILADELPHIA, PA.

Owners of the United States Phosphor-Bronze Patents.

Sole Manufacturers of Phosphor-Bronze in the United States.

MAYO ELECTRIC MFG. CO.,

160 Portland St., Boston, Mass.

CONTRACTS MADE FOR

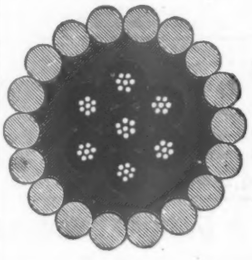
Arc & Incandescent Plants

Of the most Improved Description.

CONTRACTORS FOR WIRING, ETC.

Estimates Cheerfully & Promptly Furnished.

THE BISHOP GUTTA-PERCHA CO.,



420 to 426 East 25th St., N. Y.,

Have improved machinery and increased facilities for making

Submarine, Subterranean and Aerial Cables.

We guarantee our productions

TO BE SUPERIOR TO ANY IMPORTED,

and to sell at prices which will render importation unnecessary. All the *GUTTA-PERCHA* insulated cables made in this country have been manufactured at our works.

All kinds of Insulated Wires at the Lowest Prices.

PURE GUTTA-PERCHA FOR ALL PURPOSES.

W. W. MARKS, Supt. HENRY A. REED, Sec'y.

I. W. COLBURN & Co. MFG. OF **Dynamo-Electric Machines** Fitchburg, Mass. SEND FOR CATALOGUE

MAGNETO SIGNAL BELLS.

"STANDARD."

No Battery Required.

$4, $6, and upwards, according to style desired. **Discount on large lots.**

We make a specialty of the manufacture of these bells for Telephone Companies, and after an experience of many years, our facilities for the prompt execution of large orders are unequaled.

Close attention given to furnishing samples for special orders.

VIADUCT MANUFACTURING CO.

OF BALTIMORE.

A. G. DAVIS, President. A. B. PROAL, Secy. & Treas.

Office, North-West Corner Charles and German Streets,

ELECTRICAL GOODS OF EVERY DESCRIPTION.

Telephone, Telegraph, Electric Light, Fire Alarm and District Telegraph Supplies.

SEND FOR ILLUSTRATED CATALOGUE.

THE CALLENDER

Insulated Wires and Cables

For OVERHEAD, UNDERGROUND and SUBMARINE PURPOSES.

Further Information on Application.

THE ELECTRICAL SUPPLY CO.

175 & 177 LAKE STREET, CHICAGO.

MODEL and EXPERIMENTAL WORK A SPECIALTY. Send for Circulars. **C. E. Jones & Bro.** CINCINNATI, O. (Mention this Paper.)

Lowest Prices

FOR

BELLS,

E. W. HAZAZER,

33 Murray St., N. Y.

GEORGE J. FRITZ'S

PATENT ELECTRIC LIGHT ENGINES.

These cuts represent my Patent Single and Double Electric Light Engines, built especially to run Electric Lights.

Of the Single Engines I make 5 sizes, viz.: 4, 6, 8, 10 and 12 horse-power. Of the Double Engines I make 3 sizes, viz.: 15, 20 and 25 horse-power.

These Engines take up very little space, therefore, are very desirable and convenient where roomis valuable. With theadvantage of many years' practical experience, I have perfected an engine to meet the universal demand for small power. The engines are fitted up with Patent Self-Adjusting Piston Packing, Steel Piston Rods, Gun Metal Boxes and Babbitted Bearings. The working parts are first-class in every respect. Every engine guaranteed to give satisfaction.

The following Mississippi River Steamboats use my Engines to run their Electric Lights:

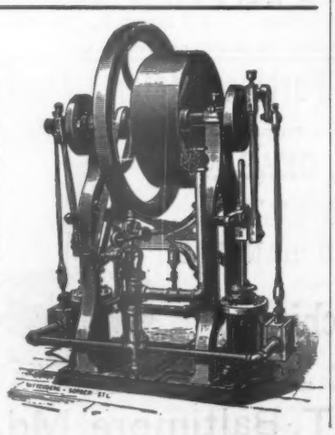
HENRY LOURY.	PORT EADS.	M. M. MICHAEL.
NORTON.	OAKLAND.	CALHOUN.
JACK FROST.	NATCHEZ.	J. C. CHAPMAN.

CENTRAL IRON WORKS,

Also Manufacturer of Steam Engines, Doctors, Pumps, Shafting, Pulleys, Hangers, and Machinery in general,

2022 to 2028 S. THIRD ST., ST. LOUIS, MO.

(SEND FOR DESCRIPTIVE PRICE LIST.)



ALFRED F. MOORE,

MANUFACTURER OF

Insulated Wire,

For Telephone, Telegraph and Electric Light.

OFFICE, LINE,

AND

ANNUNCIATOR WIRE,

Magnet Wire and Flexible Cordage,

200 & 202 N. THIRD ST.,

PHILADELPHIA, PA.

BOULTON CARBONS

These carbons are made of the BEST MATERIALS, and with the latest improved machinery, of any required degree of hardness, and can be used in all makes of Electric Lamps.
The regular sizes, 12 inches long, run from ¼ inch to 1 inch diameter, varying by sixteenths.
Special LENGTHS and SIZES to Order.
A large and complete stock always on hand.
The want of a high order of battery plate has long been felt. Those wishing such would do well to use the
BOULTON PLATES.
Special attention is given to the manufacture of all sizes to order.
Price Lists and full information furnished on application.
Also Exclusive Agents of the celebrated
AUSTRIAN Cored CARBON
for the United States.
BOULTON CARBON WORKS,
Foot of Wilson Avenue,
CLEVELAND, OHIO.

Telephone Stocks
—AND—
Chicago Local Stocks & Bonds
BOUGHT AND SOLD
On Commission by the Undersigned.
S. G. LYNCH,
144 La Salle St., Chicago (formerly Lynch & Banta).

ELECTRIC MFG. CO.
Troy, N. Y.
MAKERS OF STANDARD ELECTRICAL INSTRUMENTS, AND FINE EXPERIMENTAL WORK
Galvanometers, Resistance Coils, Condensers, Keys, Switches, &c.
BAILEY COMBINATION SET,
PRATT'S SPEED INDICATOR, &c.
SEND FOR CATALOGUE.
ELECTRIC MFG. CO., P.O. Box 80, TROY, N.Y.

STAR IRON TOWER CO.
Manufacturers of the
O'Beirne Patent
TOWERS AND MAST ARMS
FOR
Electric Lighting,
and Publishers of the
AMERICAN ELECTRICAL DIRECTORY
Fort Wayne, Indiana.

CARBONS
FOR ARC LIGHTING.
Only Manufacturers using Natural Gas, thus securing
Uniformity, Durability & Superior Light.
PITTSBURGH CARBON CO., lim'd,
PITTSBURGH, PA.

And 175 and 177 LAKE STREET, CHICAGO.

STANDARD UNDERGROUND CABLE COM'Y,
Manufacturers of
WARING'S PATENT
Telegraph, Telephone and Electric Light
CABLES,
LEAD COVERED WIRE FOR INSIDE USE, PROOF AGAINST DAMPNESS.
No. 128 Pearl St., New York City. {All Work Guaranteed.} No. 88 Fourth Ave., Pittsburgh, Pa.

Consolidated Electric Light Co.,
Owning and Operating the
SAWYER-MAN PATENTS.
THE CONSOLIDATED SAWYER-MAN ELECTRIC LIGHT SYSTEM TRADE MARK CO.
EXECUTIVE OFFICES: Mutual Life Building, NEW YORK.
PHILADELPHIA OFFICE: 205 Walnut Place.
CHARLES H. BANES, President. HUGH R. GARDEN Vice President.
HENRY C. DAVIS, Treas. and General Manager.
Plans and Estimates Furnished for all kinds of INCANDESCENT LIGHTING.
ESTIMATES FURNISHED for the Thomson-Houston System of Arc Lighting.

Schuyler Electric Light Co.,
Manufacturers of
DYNAMO MACHINES
FOR INCANDESCENT AND ARC.
The most perfect system of both Incandescent and Arc Lighting. Entire freedom from hissing and flickering in our Arc Lights, and long life and great brilliancy in our Incandescent Lights.
Dynamo Machines with perfect automatic regulation, reliable and efficient.
Prices moderate. Estimates made for lighting from Central Stations or for isolated plants. Illustrated Circulars sent upon application. Address
SCHUYLER ELECTRIC LIGHT CO.,
Hartford, Conn.
New York Office: 44 BROADWAY.

HENRY S. LYTLE. GEO. L. BEETLE. FRANK B. KNIGHT.
LYTLE AND COMPANY,
15 CORTLANDT STREET, NEW YORK.
MANUFACTURERS' AGENTS.
Electrical Supplies and Apparatus
OF EVERY DESCRIPTION.
LICENSEES
TELEGRAPHIC TIME COMPANY
In States of New York, New Jersey, Penn., Ohio, Indiana, Missouri, Wisconsin, Minnesota and Kansas.
Information Furnished Upon Application.

WARNER'S PATENT ELECTRIC GAUGE
FOR INDICATING THE STRENGTH OF
BATTERY CURRENTS,
SIMPLE, ACCURATE, RELIABLE.

The condition of a cell of battery or the strength of a battery current passing over a line can be ascertained in a moment by the most inexperienced.
INVALUABLE FOR TELEPHONE, ELECTRIC CLOCK, FIRE ALARM OR OTHER ELECTRIC SERVICE.
Full particulars by mail on application.
LYTLE & CO.,
SOLE AGENTS,
No. 15 Cortlandt Street, New York.

MODEL and EXPERIMENTAL WORK A SPECIALTY. Send for Circulars. C. E. Jones & Bro. CINCINNATI, O. (Mention this Paper.)

B. TROPP,
The Cheapest House in the Trade for
ELECTRIC BELLS,
RUHMKORFF SPARK COILS.
285 Atlantic Avenue, Brooklyn, L. I.

THE
United States Electric Lighting Co.
SOLE MANUFACTURERS OF
WESTON
DYNAMO MACHINES
FOR BOTH
Arc and Incandescent Lighting and Electroplating.
WESTON ARC LAMPS,
Weston Incandescent Lamps,
ELECTRIC MOTORS, AUTOMATIC REGULATORS,
Fixtures, Fittings, &c.
THE WESTON SYSTEMS OF
Arc and Incandescent Lighting
ARE SUPERIOR TO ALL OTHERS IN
EFFICIENCY, SAFETY, RELIABILITY AND
Perfection of Automatic Regulation.
Full information with prices and Estimates furnished upon application.
General Office, 59 & 61 Liberty St., New York.
Chicago Office, 185 LA SALLE STREET.

TELEGRAPHIC TIME COMPANY,

14 & 15 TEMPLE COURT, 5 BEEKMAN ST.

NEW YORK.

OWNERS OF PATENTS COVERING THE ONLY COMPLETE ELECTRIC TIME SYSTEM, WHICH HAS BEEN SUCCESSFULLY OPERATED ON AN EXTENSIVE SCALE, IN THE WORLD.

THIS Company, recently organized, has acquired all the Patents and Contracts of the TIME TELEGRAPH COMPANY and a large number of valuable and entirely new base patents covering Electro-Mechanical Clocks and Synchronizing Devices. Two years of service in New York, Boston, Providence and other large New England Cities have demonstrated the perfect reliability of this System. Highest testimonials at the Philadelphia Electrical Exposition and from Electrical Experts and practical Clock Manufacturers and Dealers, also from subscribers who are using the System in 20 of the prominent cities of the United States.

TERRITORIAL RIGHTS FOR SALE UPON LIBERAL TERMS. CORRESPONDENCE SOLICITED IN RELATION TO THE INTRODUCTION OF THE BUSINESS INTO PORTIONS OF THE UNITED STATES FOR WHICH LICENSES HAVE NOT BEEN GRANTED.

38 Conductor Aerial Telephone Cable.

DAY'S Kerite Insulated WIRES AND CABLES

For Telephone, Telegraph and Electric Light Use and Electrical Circuits Generally.

The reliability and durability of Kerite Insulation is unsurpassed, as has been proven by years of experience. All rubber and gutta-percha compounds are very short-lived when placed either in the air or underground, and the supposed new insulating materials now being presented to the public, are most of them old and discarded experimental products. The present high standard and uniform quality of Kerite is the result of 30 years' experience.

The attention of TELEPHONE MANAGERS is especially asked to our ANTI-INDUCTION TELEPHONE CABLES, they being the most practical and durable in the market.

TELEGRAPH, TELEPHONE and ELECTRIC LIGHT Wires, for either SUBMARINE or UNDERGROUND work a specialty. Estimates for complete systems of underground wires and conduits will be furnished on application.

AUSTIN G. DAY, Sole Manufacturer.

CLARK B. HOTCHKISS, Gen'l Agent,

120 BROADWAY, NEW YORK.

THE BEST IS THE CHEAPEST.

The Brush-Swan Electric Light Co. of New England.

W. L. STRONG, President. C. P. WHITNEY, Secretary.
A. D. JUILLIARD, Vice-President. R. W. ABORN, Treasurer.
JOHN B. POWELL, General Manager.

REMOVED TO Nos. 204, 206, 208, 210 ELIZABETH ST., NEW YORK.

WHERE ELECTRICAL APPARATUS FOR ALL THE VARIOUS MODES OF LIGHTING AND TRANSMITTING OF POWER ARE IN OPERATION.

NO OTHER SYSTEM IS AS ECONOMICAL IN INSTALLATION AND MAINTENANCE.

NO OTHER ELECTRIC LIGHT APPARATUS IS AS DURABLE.—THE FIRST MACHINES MADE ARE STILL IN DAILY OPERATION.

THE SYSTEM COMPRISES:
- Arc Lights of various Sizes.
- Arc and Incandescent Lights from one Dynamo and Circuit.
- Incandescent Lights of various Sizes from Special Dynamo for Central Station Lighting.

Cost of Apparatus Greatly Reduced. Surveys and Estimates Furnished by Experts.

☞ This company owns and controls all the Patents for ARC LIGHTING issued to CHAS. F. BRUSH, of Cleveland, for the New England States, New York, Pennsylvania, New Jersey, Delaware, Maryland, and the District of Columbia; also the Swan Patents for the same territory.

G. W. STOCKLY, President. J. J. TRACY, Vice-Prest. W. F. SWIFT, Secretary.
J. POTTER, Treasurer. N. S. POSSONS, Supt. W. J. POSSONS, Asst. Supt.

THE BRUSH ELECTRIC CO.,

The Sole Manufacturers, under all the patents of Charles F. Brush, for Electric Lighting, Storage Batteries, Carbons, Electro-Plating Machines, Electric-Motors, &c.

WE FURNISH the ONLY COMPLETE and PERFECT SYSTEM OF ELECTRIC LIGHTING.

Machines for Arc Lighting, giving lights of 1,200, 2,000, 3,000, 4,000 and up to 100,000 candle power. Our No. 8 machine gives 65 lights of 2,000 c. p. with about 45 H. P.

Over twenty different styles of arc lamps, for indoor and outdoor use, and for tower lighting.

MACHINES FOR INCANDESCENT LIGHTING,

adapted for use with Swan Incandescent lamps. These machines are automatic and do not require the use of any switches or resistances outside of the machine to govern the current. Will run any number of lamps from one up to the full capacity of the machine, without change of speed and without the use of any apparatus outside of the machine.

Our prices are lower than other makers.

Storage Batteries, for Incandescent Lighting and for Electric Motors. Our storage batteries are the only practical ones offered in the market. They are especially adapted for situations where lights are needed for only four or five hours per day and where it is convenient to use power during the day to store up the current. There are thousands of such places where our storage battery must eventually be used.

CARBONS FOR ARC LAMPS.

Our carbons are the purest and best made. We have the largest and most fully equipped carbon factory in the world and our prices are very low.

ELECTRIC MOTORS.

We have commenced the manufacture of the Brush Electric Motors and shall soon be prepared to fill orders for all sizes from one up to forty horse-power. In many locations these are the most economical producers of power and will be largely used by Lighting Companies and others where small powers are required.

THE BRUSH ELECTRIC CO., *104 EUCLID AVENUE, Cleveland, O., U. S., A.*

ANSONIA BRASS & COPPER CO.,

Manufacturers of

Pure Electric Copper Wire,

BARE AND COVERED, OF EVERY DESCRIPTION.

"ACME" BRONZE TELEGRAPH AND TELEPHONE WIRE.

Warerooms: 19 & 21 Cliff St., New York. Factories: Ansonia, Conn.

HOLMES, BOOTH & HAYDENS,

Manufacturers of

Hard-drawn Copper Wire

For Telegraph and Telephone.

Patent Electric Light Wire, Magnet Wire,
Patent "K. K." Copper and Iron Wire, &c.

Sole Agents for the

Forest City Carbon Mfg. Co.

NEW YORK, BOSTON AND PHILADELPHIA. FACTORIES: Waterbury, Conn.

BRIDGEPORT BRASS CO.,

BRIDGEPORT, CONN.,

INCORPORATED 1865.

BRASS, COPPER AND GERMAN SILVER

WIRE AND ROLLING MILLS,

Bare and Insulated Copper Wire for Electric Conductors a specialty.

SOLE AGENTS FOR THE

BRIDGEPORT ELECTRIC MFG. CO.

The Armington & Sims

AUTOMATIC CUT-OFF ENGINE.

For all purposes where power is required.

CLOSE REGULATION,
ECONOMICAL OF FUEL,
SMALL SPACE REQUIRED,
MODERATE PRICE.

Over 1700 Engines in Use.

SELLING AGENTS:

JARVIS ENGINEERING CO., 61 Oliver St., Boston.	T. W. ANDERSON, New Orleans, La.
POND ENGINEERING CO., St. Louis, Mo.	E. P. HAMPSON & CO., 36 Cortlandt St., New York.
J. F. RANDALL, Warren, Ohio.	TANNER & DELANEY ENGINE CO., Richmond, Va.
JOHN R. MARKLE, Detroit, Mich.	MORTON, REED & CO., Baltimore, Md.
H. B. SMITH MACHINE CO., 925 Market St., Phil., Pa.	WM. MINNIGERODE, Atlanta, Ga.

Shultz Belting Company,

MANUFACTURERS OF

SHULTZ PATENT FULLED LEATHER BELTING AND LACE LEATHER.

Office and Factory: Cor. Bismarck and Barton Sts., St. Louis, Mo.

Our Belting is made of leather tanned on the surface only; the interior (which is the fiber and strength of the hide) is not tanned, but rawhide fulled and softened by our patented process. Our Belting is more pliable, hugs the pulley better, transmits more power than any other, and is the only perfect ELECTRIC LIGHT BELT MADE. Agents in all cities. Send for trial belt.

THE ELECTRICAL SUPPLY CO.

MANUFACTURERS OF

Insulated Wire

OF EVERY DESCRIPTION.

ELECTRIC LIGHT, TELEPHONE, AND TELEGRAPH SUPPLIES.

Warehouses: 17 DEY ST., NEW YORK. 175 & 177 Lake St., Chicago.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue C. E. JONES & BRO. Cincinnati, O.

It is important to us that you mention this paper.

MITCHELL, VANCE & CO.,

GAS FIXTURE MANUFACTURERS,

Have added a department for the Manufacture of Electroliers and other fixtures adaptable to any system of Incandescent Electric Lighting, also Combination Fixtures for both Gas and Electric Light. Estimates and designs furnished upon application.

836 & 838 BROADWAY,
NEW YORK.